

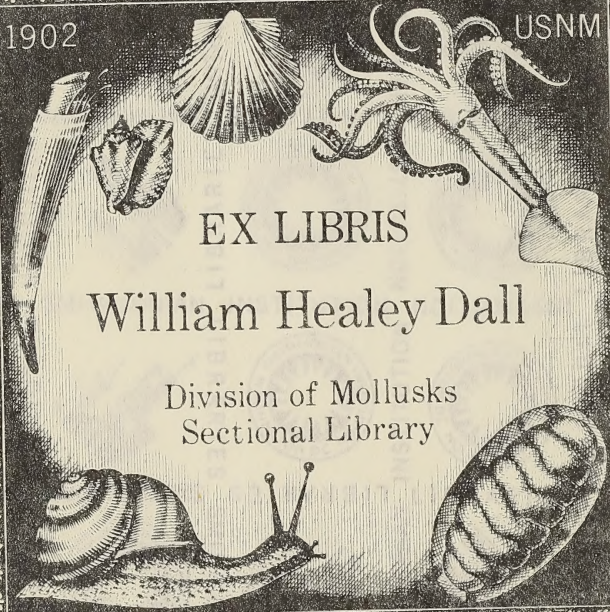
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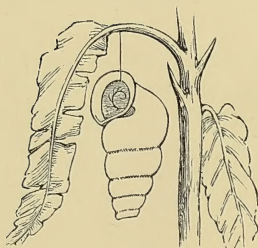
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Vol. II. 1874-1876.

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BY
William Greene
W. G. BINNEY.



BURLINGTON, N. J.:
PRINTED FOR THE AUTHOR.
1876.

NOTICE

AFTER CAREFUL EXAMINATION OF THE
INNER MARGIN AND TYPE OF MATERIAL
WE HAVE SEWN THIS VOLUME BY HAND
SO IT CAN BE MORE EASILY OPENED
AND READ.

Vol II of my "Notes" contains the following:

PART I.

No. 64. On the Anatomy and Lingual Dentition of *Ariolimax* and other Pulmonata: from Proceedings of the Academy of Natural Sciences of Philadelphia, 1874, pp. 33—63, pls. ii—xi: actually distributed, May, 1874.

PART II.

No. 65. On the Genitalia and Lingual Dentition of Pulmonata: from the Annals of the Lyceum of Natural History of New York, Vol. XI, June, 1874, pp. 20—46, pls. i—vi: actually distributed, Sept., 1874.

PART III.

No. 66. On the Jaw and Lingual Dentition of North American Terrestrial Pulmonata: from same as Part I, 1875, pp. 140—243: pl. i—xviii: actually distributed Sept., 1875.

No. 67. On the Lingual Dentition and Genitalia of *Partula* and other Pulmonata: from same as last, pp. 244—254: pl. xix—xxi: distributed with the last.

PART IV.

No. 68. On the Genitalia, Jaw and Lingual Dentition of certain species of Pulmonata: from same as No. 65, Vol. XI, pp. 166—196, pls. xii—xviii, October, 1875: actually distributed, March, 1876.

The above comprises all that I have published subsequent to the distribution of the title page and table of contents of Vol. I. Copies of this title, as well as of most of the papers and works therein enumerated, and also separate copies of the plates of Vols. III and IV of "Terrestrial Mollusks and Shells of the United States" may be obtained of the American Naturalist's Book Agency, at Salem, Mass.

W. G. BINNEY.

Burlington, New Jersey, March, 1876.



ON THE LINGUAL DENTITION AND JAW OF CERTAIN TERRESTRIAL
PULMONATA FROM THE UNITED STATES, WITH REMARKS ON THEIR
SYSTEMATIC VALUE.

BY THOMAS BLAND AND W. G. BINNEY.

The character of the jaw and lingual dentition of the various genera and subgenera of our land shells is now so well known, and apparently so constant, that we have not thought it necessary to give full descriptions in each case. We simply refer to a published description or figure under each genus or subgenus, unless some unusual feature has been observed. The number of ribs upon the jaw is given approximately when there is a difficulty in deciding whether certain stages of thickening of the material of the jaw shall be counted as rudimentary ribs or not.

MACROCYCLIS DURANTI, Newcomb.

Los Angeles, California, Mr. Henry Hemphill.

On examining the lingual membrane, we find it does not agree with that of *Hyalina* or *Zonites*, but with that of *Macrocyclus Vancouverensis*, *sportella* and *concava*. The species must therefore be recognized as a *Macrocyclus*.

The jaw was injured in extraction and imperfectly examined. It seems, however, to have the usual characteristics of the genus.

LIMAX CAMPESTRIS, Binney.

New Jersey, W. G. Binney.

Jaw and lingual membrane as usual in the genus.

ZONITES LIMATULUS, Ward.

Near Cincinnati, Ohio. Mr. A. G. Wetherby.

The species has the longitudinal furrows along the side, above the foot, and the caudal mucus slit, as in *Zonites suppressus*, (see our fig. 524 on p. 292 of Land and Fresh-water Shells of N. A., I.) In two individuals examined we found the sac and dart as figured by Leidy in *Z. ligerus* (Terr. Moll., I, pl. xii. fig. 3).

Jaw and lingual membrane as usual in the genus.

VITRINA PFEIFFERI, Newcomb.

Lake Tahoe, California, Dr. J. G. Cooper.

Jaw and lingual membrane as usual in the genus (see our fig. 21, 22, on p. 26, l. c.). About ten lateral teeth. Marginals bluntly bifid as usual.

VITRINA EXILIS, Morel.

Petropaulouski, W. H. Dall. The species is also found in Alaska.

Jaw and lingual membrane as usual in the genus, the former with ends somewhat recurved as in our figure of *Zonites arboreus* (l. c. p. 33). About seven lateral teeth.

HELIX MOOREANA, W. G. Binney. (*Polygyra*.)

Bosque County, Texas. Mr. Hugo W. Ericsson.

Jaw¹ with about fifteen, adjoining, broad ribs, denticulating either margin.

Lingual membrane as in *Polygyra*.¹

HELIX HAZARDI, Bland. (*Polygyra*.)

Munroe Co., Tennessee, Miss Annie E. Law.

Jaw as usual in *Polygyra*, ribs adjoining, stout, denticulating either margin.

Lingual membrane as in *H. auriculata* (see our fig. l. c.).

HELIX AURIFORMIS, Bland. (*Polygyra*.)

Savannah, Georgia.

Jaw with ribs as usual in the subgenus—see last species.

Lingual membrane as usual in the subgenus. (See *H. Mooreana*, above.)

HELIX HIRSUTA, Say. (*Stenotrema*.)

New Jersey, T. Bland.

Jaw as usual in the subgenus.² Lingual membrane already described by us. (l. c. p. 119, fig. 197.)

HELIX SPINOSA, Lea. (*Stenotrema*.)

Philadelphia, Munroe Co., Tenn. Miss Annie E. Law.

Jaw as usual in *Stenotrema*.²

Lingual membrane as usual in the subgenus.²

HELIX RUGELI, Shuttleworth. (*Triodopsis*.)

Philadelphia, Munroe Co., Tenn. Miss Annie E. Law.

¹ See our figures l. c. p. 87 and 92.

² The jaw in *Stenotrema* is arcuate, ends blunt, anterior surface with crowded, broad ribs, denticulating either margin. See our figure of the jaw of *H. monodon*, l. c. p. 122, fig. 204. For lingual membrane, see fig. 205.

Jaw with about ten ribs; as usual in the subgenus.¹

Lingual dentition as usual.¹

HELIX FALLAX, Say. (*Triodopsis*.)

Philadelphia, Munroe Co., Tenn. Miss Annie E. Law.

Lingual membrane and jaw as usual in *Triodopsis*,¹ the latter with about fourteen ribs.

HELIX TRIDENTATA, Say. (*Triodopsis*.)

Same locality as last.

Jaw as usual in the subgenus.¹

Lingual membrane already figured by us. (l. c. fig. 220, p. 130.)

HELIX HOPETONENSIS, Shuttleworth. (*Triodopsis*.)

Charleston, S. C. Mr. W. G. Mazyck.

Jaw with over ten ribs; as usual in the subgenus.¹

Lingual membrane as usual.

HELIX DENTIFERA, Binney. (*Mesodon*.)

Mohawk, New York. Dr. James Lewis.

Jaw with fourteen ribs; as usual in the subgenus.²

Lingual membrane as usual.² The marginal teeth remind us of those of *Helix thyroides* (l. c. p. 148, fig. 252), but the inner denticle is more obtusely pointed. The figure referred to is liable to mislead. The marginals are subquadrate (not aculeate), with one long, oblique, sharply pointed denticle, much more produced than usual in the genus.

HELIX ROËMERI, Pfr. (*Mesodon*.)

Bosque Co., Texas. Mr. Hugo W. Ericsson.

Animal externally as in *H. thyroides*, *dentifera*, etc.

Jaw and lingual membrane as usual in the subgenus,² the former with over seven ribs.

HELIX ELEVATA, Say. (*Mesodon*.)

Philadelphia, Munroe Co., Tenn. Miss Annie E. Law.

¹ In *Triodopsis* the jaw is arcuate, ends blunt, anterior surface with stout, adjoining ribs, which denticulate either margin. See our fig. 214, p. 127, l. c. For lingual dentition, see fig. 215.

² In *Mesodon* the jaw is arcuate, ends blunt; anterior surface with stout, separated ribs, denticulating either margin. See our fig. 231, on p. 137, l. c. The lingual dentition is figured on p. 138, fig. 232. The central and lateral teeth are obtuse, short, stout, with obsolete side denticles to the reflected cusps.

Lingual membrane and jaw as usual in the subgenus,¹ the latter with over twelve ribs.

HELIX GERMANA, Gould. (*Mesodon*.)

California, Mr. Henry Hemphill.

Jaw more resembling the type usual in the subgenus *Stenotrema* than *Mesodon*, the ribs, eleven in number, being broad and crowded.

Lingual membrane as usual in *Helix*.

There are forms of *H. germana* closely connecting the species with *H. Columbiana*, Lea. The jaw of the latter is described by Dr. Cooper as strongly arched, with eight broad ribs.

HELIX GRISEOLA, Pfr. (*Fruticicola*.)

Bosque Co., Texas. Mr. Hugo W. Ericsson.

Jaw with about ten broad, crowded ribs, denticulating the cutting margin; upper margin with membranous attachment. The jaw is somewhat of the type figured by Moquin Tandon for that of *Helix hispida*. (See our fig. 274, p. 159, l. c.)

Lingual membrane as usual in the genus *Helix*. The reflected cusps of the teeth are short, stout. Marginals with blunt denticulations.

HELIX SEQUOICOLA, J. G. Cooper. (*Arionta*.)

Jaw as usual in the subgenus.² Ribs from four to six.

Lingual membrane as usual in the subgenus. Central and lateral teeth with short, stout cusps. Marginals with two bluntly bifid denticles.

HELIX EXARATA, Pfr. (*Arionta*.)

Santa Cruz, California, Mr. Henry Hemphill.

Lingual membrane and jaw as usual in the subgenus,² the latter with six ribs.

HELIX TRASKI, Newcomb. (*Arionta*.)

Los Angeles, California, Mr. Henry Hemphill.

Lingual membrane and jaw as usual in the subgenus,² the latter with eight ribs, five stout, three slight.

¹ See note 1 to p. 242.

² In *Arionta* the jaw is strongly arched, ends blunt; anterior surface with a few, stout, distant ribs, projecting far beyond, and deeply scalloping either margin. See our figure of that of *H. redimita* in Am. Journ. of Conch. VI. pl. ix. fig. 11. For lingual dentition, see our fig. 284, p. 164, of Land and Fresh-water Shells of N. A., I.

HELIX AYRESIANA, Newcomb. (*Arionta*.)

San Miguel Island, California. Mr. Henry Harford.

Animal long and slender, smoky-white, covered with white coarse granulations running longitudinally down the back, one line of granulations very prominent and central, bordered on either side with a deep furrow. Also oblique lines of granulations running down the sides of the foot. Foot dirty-white below. Tail short, broad, pointed. Some individuals are darker, with a purplish tinge.

Jaw and lingual membrane as usual in the subgenus,¹ the former with six ribs.

HELIX RUFICINCTA, Newcomb. (*Arionta*.)

Catalina Island, California. Mr. Henry Hemphill.

Jaw more like the type common in *Mesodon* than in *Arionta*, i. e., arcuate rather than arched, margins rather pectinated than scalloped by the ends of the ribs, which are about ten in number.

Lingual membrane as usual in the subgenus.¹

HELIX KELLETTI, Forbes. (*Arionta*.)

Catalina Island, California. Mr. Henry Hemphill.

Jaw and lingual membrane as usual in the subgenus,¹ the former with about six ribs.

HELIX NEWBERRYANA, W. G. Binney. (*Glyptostoma*.) See our plate I., fig. 12, 3.

San Diego, California. Mr. Henry Hemphill.

This species belongs to no described section or subgenus, we propose for it, therefore, the name *Glyptostoma*, (γλυπτος, στωμα), from the peculiar sculptured lines which revolve upon the parietal wall.

GLYPTOSTOMA, subgen. nov.

Testa late umbilicata, depressa, ruguloso-striata, solida, anfractus 6, ultimus depresso-globosus, antice non descendens; apertura obliqua, sub-circularis; peristoma simplex, acutum, intus incrassatum, marginibus approximatis, columellari brevi, vix reflexiusculo.

Maxilla arcuata, costis validis distantibus (circa 16) exarata; margines valde dentati.²

Lamina lingualis ut in *Helice* videtur; dentes marginales subquadrati.

¹ See note 2 to p. 243.

² See our plate I., fig. 1, and the explanation of the plate.

Systema sexuale simplex;¹ desunt sagitta, bursa, flagellum, et vesica multifida. Orificium ut in *Helice* positum.

Externally, the animal resembles that of *Helix*. It is bluish-slate colored.

We have already described and figured the lingual dentition (see Am. Journ. Conch., VII. 190, pl. xvii. fig. 3, 4). The jaw is long, low, slightly arcuate; ends blunt; anterior surface with about sixteen stout, separated ribs, scalloping either margin. The jaw is lower, less arcuate and longer than in *Arionta*. Its ribs resemble those of that subgenus in projecting far beyond and scalloping the margins of the jaw, but they are much more numerous.

This description applies only to the more perfect form of the jaw (fig. 1 of our plate), noticed only in one individual. In several other individuals the ribs on the jaw were much more narrow and less projecting at the upper and lower margins. There is more difference between these than is usually found in different individuals of the same species.

SUCCINEA CAMPESTRIS, Say.

Charleston, S. C. Mr. W. G. Mazyck.

Jaw as usual in the genus; the anterior surface has no decided ribs.

Lingual membrane as usual in the genus (see our figure on p. 267, l. c.).

SUCCINEA LINEATA, W. G. Binn.

Little Colorado River, Arizona. Dr. E. Palmer.

Jaw and lingual membrane as usual in the genus, the former without distinct anterior ribs.

Having published many descriptions and figures of the jaws and lingual dentition of mollusks, mostly terrestrial, we here propose to review our work, to see how nearly our observations agree with the generic descriptions published by Albers and von Martens for the various genera. We give below a list of our descriptions published previous to 1873 in other works than the Land and Fresh-water Shells of North America, Parts I. II. and

¹ See our plate, fig. 3. There is one accessory organ, of use unknown to us. See below, explanation of plate.

III., and the second edition of the Invertebrata of Massachusetts. In cases where we have not published together, the name of the separate author is given.

PULMONATA GEOPHILA.

(a.) *Without jaw.*

Gonospira sulcata, Müller. Ann. Lyc. N. H. of N. Y., X. 222. See next species.

Gonospira palanga, Fér. Am. Journ. Conch., V. 37, pl. xi. fig. 1, photograph.

Lingual membrane quite distinct from *Pupa*, in which it is placed by von Martens.

Glandina rosea, Fér. Am. Journ. Conch., VI. 202, fig. 1.

(b.) *With jaw in one single piece.*

?**Hyalina Baudoni**, Petit. (*Mörchia*.) Am. Journ. Conch., VII. 175. There are no lateral teeth as usual in *Hyalina*. The lingual is like that of *Macrocyclus*, to which genus we believe it belongs.

Macrocyclus Voyana, Newc. Am. Journ. of Conch., VII. 175.

We have shown the dentition to be peculiar in this genus.

Stenopus Guildingi, Bland. Ann. Lyc. N. H. of N. Y., VIII. 158, fig. 3. T. Bland.

Nanina Calias, Benson. Am. Journ. Conch., VII. 188, pl. xvii. fig. 6, 8.

Lingual membrane not given in Albers' ed. 2. We have shown that it differs from Troschel's figures.

Nanina cultrata, Gould. Am. Journ. Conch., VII. 189.

Nanina inversicolor, Fer., **leucostyla**, Pfr., **rufizonata**, H. Ad., **militaris**, Pfr. Ann. Lyc. N. H. of N. Y., X. 169.

All shown by us not to belong to the genus *Helix*.

Limax flavus, Lin. Copied in Am. Naturalist, IV. 167, fig. 42, 43. W. G. B.—Ann. Lyc. N. H. of N. Y., IX. 285, fig. 6.

Limax maximus, Lin. Am. Journ. Conch., VI. 203.

Zonites capsella, Gould. Am. Journ. Conch., VII. 174.

Zonites ligerus, Say. Am. Journ. Conch., VII. 174.

Zonites gularis, Say. Am. Journ. Conch., VII. 174.

Zonites intertextus, Say. Pr. Phila. Ac. N. Sc., 1872, 135.

Zonites demissus, Binney. Proc. Phila. Ac. N. Sc., 1872, 135.

Zonites lasmodon, Phillips. Proc. Phila. Ac. N. Sc., 1872, 135.

Zonites internus, Say. Proc. Phila. Ac. N. Sc., 1872, 135.

Zonites lævigatus, Pfr. Ann. Lyc. N. H. of N. Y., IX. 284, fig. 4.—Proc. Ac. N. Sc. Phila., 1872, 135.

Pallifera dorsalis, Binney. Proc. Phila. Ac. N. Sc., 1872, 137.

Hemphillia glandulosa, Ann. Lyc. N. H. of N. Y., X. pl. ix. fig. 15, 16, 17.

Ariolimax Columbianus, Gould. Am. Journ. Conch., I. 48, pl. vi. fig. 12, 13. W. G. B.

Veronicella Floridana, Binney. Ann. Lyc. N. H. of N. Y., IX. 285, fig. 5.

Veronicella. Am. Journ. Conch., VII. 163, pl. xii. fig. 7.

Bulimus oblongus, Müll. (*Borus*.) Am. Journ. Conch., VII. 180.

Bulimus pardalis, Fer. (*Dryptus*.) Am. Journ. Conch., VII. 181.

Bulimus marmoratus, Dunker. (*Dryptus*.) Am. Journ. Conch., VII. 181.

Jaw not examined.

Bulimus multicolor, Rang. (*Anthinus*.) Am. Jour. Conch., VI. 208. The jaw is ribless, thus differing from description of *Bulimus*.

Bulimus Hanleyi, Pfr. (*Orphnus*.) Am. Journ. Conch., VI. 208.

Jaw quite unlike generic description. Strongly arched, with a median projection, ribless.

Bulimus magnificus, Grat. (*Orphnus*.) Am. Journ. Conch., VI. 208. Jaw quite like generic description.

Bulimus odontostomus, Sowb. (*Macrodontes*.) Am. Journ. Conch., VI. 209.

The jaw differs from the generic description in being ribless.

Bulimus aulacostylus, Pfr. (*Eurytus*.) Ann. Lyc. N. H. of N. Y., X. 222.

The jaw as in *Bulimulus*.

Bulimus auris-Sileni, Born. (*Pelecychilus*.) Same as last species.

Cochlostyla fulgetrum, Brod. Am. Journ. Conch., VII. 180.

Jaw not described in Albers and v. Martens. We find it with ribs.

Limicolaria Numidica, Reeve. Am. Journ. Conch., VII. 181.

Jaw differs from the generic description in being ribless.

Eucalodium Newcombianum, Gabb (= **Berendtia Tylori**, Pfr.). Ann. Lyc. N. H. of N. Y., VIII. 175, fig. 3. T. Bland.

Stenogyra decollata, Lin. Am. Journ. Conch., VII. 183.

Stenogyra gonostoma, Gundl. Am. Journ. Conch., VII. 183.

Stenogyra octona, Chemn. Am. Journ. Conch., VII. 183.

We have shown the peculiar characters of the dentition constant in the three species.

Clausilia tridens, Chemn. Am. Journ. Conch., VII. 28, pl. ii. fig. 1-5, 7, 8.

Amphibulima patula, Brug. Am. Journ. Conch., VII. 186, pl. xvii. fig. 1, 2, lingual membrane. Jaw in Ann. Lyc. N. H. of N. Y., X. 225, pl. xi., fig. 8.

We have shown the jaw and dentition to be unlike *Succinea*.

Pellicula? appendiculata, Pfr. Ann. Lyc. N. H. of N. Y., X. 206, pl. ix. fig. 2, 9-11.

Bulimulus pallidior, Sowb. Ann. Lyc. N. H. of N. Y., IX. 282, fig. 2, lingual.

Bulimulus laticinctus, Guppy. Ann. Lyc. N. H. of N. Y., X. 81, pl. ii. fig. 1, 5.

The teeth are peculiarly modified.

Bulimulus Bahamensis, Pfr. Ann. Lyc. N. H. of N. Y., X. 82, pl. ii. fig. 3, 4.

The teeth are peculiarly modified.

Bulimulus sufflatus, Gould. Am. Journ. Conch., VI. 209, pl. ix. fig. 8, 13.

Bulimulus Marielinus, Poey. Am. Journ. Conch., VI. 209. Jaw alone.

Bulimulus Jonasi, Pfr. Am. Journ. Conch., VII. 182, as in *B. aureolus*.

Bulimulus aureolus, Guppy. Am. Journ. Conch., VII. 181.

Lingual membrane as in *B. laticinctus*. Jaw not examined.

Bulimulus alternatus, Say. Am. Journ. Conch., VII. 181.

Bulimulus membranaceus, Phil. Am. Journ. Conch., VII. 182.

Teeth as in *B. laticinctus*.

Bulimulus dealbatus, Say. Am. Journ. Conch., VII. 182. Jaw only.

Bulimulus Berendti, Pfr. Am. Journ. Conch., VII. 182.

The species referred to proves to be *B. corneus*, Sow.

Bulimulus durus, Spix. Am. Journ. Conch., VII. 182.

Cylindrella subula, Fér. Am. Journ. Conch., VII. 183.

Cylindrella seminuda, Ad. Am. Journ. Conch., VII. 184.

Cylindrella rosea, Ad. Am. Journ. Conch., V. 37, pl. xi. fig. 2, photograph.

Cylindrella scæva, Gundl. Ann. Lyc. N. H. of N. Y., VIII. 161, fig. 4. Lingual membrane only. Ibid. IX. 77. T. Bland.

Cylindrella Blandiana, Pfr. Ann. Lyc. N. H. of N. Y., IX. 85, fig. 5. T. Bland.

Cylindrella trinitaria, Pfr. Am. Journ. Conch., IV. 187, fig. T. Bland. Jaw first noticed, also jaw described in *C. rosea*, *sanguinea*, *brevis*, *Maugeri*, *gracilis*, *elongata*, *Bahamensis*, *scæva*, *Elliotti*, *Brooksiana*.

Macroceramus Gossei, Pfr. Am. Journ. Conch., VII. 187, pl. xvii. fig. 9, 11, 12.

Teeth quite different from the form usual in *Cylindrella* and *Macroceramus*.

Macroceramus signatus, Guild. Ann. Lyc. N. H. of N. Y., VIII. 162, fig. 5, 6. Ibid. IX. 84. T. Bland.

Pineria Viequensis, Pfr. Ann. Lyc. N. H. of N. Y., X. 26.

Lingual membrane entirely distinct from *Pupa*, where it is placed by von Martens.

Patula strigosa, Gould. Proc. Phila. Ac. N. Sc., 1872, 135.

Patula Idahoensis, Newc. Same as last, 136.

Patula Cooperi, W. G. Binn. Same as last, 136.

Patula perspectiva, Say. Same as last, 136.

Patula solitaria, Say. Am. Journ. Conch., VII. 176.

Patula Hemphilli, Newcomb. Am. Journ. Conch., VI. 207, pl. ix. fig. 3.

Patula Cooperi, W. G. Binn. Am. Journ. Conch., VI. 207. Jaw.

Sagda connectens, Ad. Am. Journ. Conch., VII. 175.

The marginal teeth are quadrate, not aculeate, proving the genus to belong to the *Helicea*, not to the *Vitrinea*.

Sagda Haldemaniana, Adams. Am. Journ. Conch., VII. 175. See last species.

Sagda Jayana, Adams. Ann. Lyc. N. H. of N. Y., X. 219. See last species.

Helix circumfirmata, Redf. (*Microphysa*.) Ann. Lyc. N. H. of N. Y., X. 221.

The species shown to belong to the *Vitrininae*.

Helix turbiniformis, Pfr. (*Microphysa*.) Ann. Lyc. N. H. of N. Y., X. 79, pl. ii. fig. 2.

Jaw unusual in the genus—resembling that of *Bulimulus*.

Helix Boissieri, Charp. (*Leucochroa*.) Ann. Lyc. N. H. of N. Y., X. 220.

The species shown to be more nearly related to *Helix* than to any of the *Vitrininae*.

Helix Yatesii, J. G. Cooper. (*Gonostoma*.) Am. Journ. Conch., VII. 176.

Helix polygyrella, Bland and Cooper. (*Polygyrella*.) Proc. Phila. Ac. N. Sc., 1872, 136.

Helix microdonta, Desh. (*Polygyra*.) Am. Journ. Conch., VI. 205.

Helix septemvolva, Say. (*Polygyra*.) Am. Journ. Conch., VI. 206.

Helix fastigans, L. W. Say. (*Polygyra*.) Am. Journ. Conch., VII. 176.

Helix stenotrema, Fer. (*Stenotrema*.) Am. Journ. Conch., VI. 207.

Helix loricata, Gould. (*Triodopsis*.) Am. Journ. Conch., VI. 206.

Helix inflecta, Say. (*Triodopsis*.) Am. Journ. Conch., VI. 206.

Helix palliata, Say. (*Mesodon*.) Proc. Phila. Ac. N. Sc., 1872, 136.

Helix obstricta, Say. (*Mesodon*.) Same as last, 136.

Helix devia, Gould. (*Mesodon*.) Proc. Phila. Ac. N. Sc., 1872, 136.

Helix similis, Fér. (*Dorcasia*.) Am. Journ. Conch., VII. 176.

Helix Newberryana, W. G. B. Am. Journ. Conch., VII. 190, pl. xvii. fig. 3, 4.

Helix fidelis, Gray. (*Aglaja*.) Am. Journ. Conch., VI. 207, pl. ix. fig. 1, 9.

Jaw said to be ribless, but a better specimen found normal, Proc. Phila. Ac. N. Sc., 1872, 136.

Helix redimita, W. G. Binn. (*Arionta*.) Am. Journ. Conch., VI. 206, pl. ix. fig. 11.

Helix tudiculata, Binney. (*Arionta*.) Am. Journ. Conch., VI. 208, pl. ix. fig. 7.

Helix Townsendiana, Lea. (*Arionta*.) Am. Journ. Conch., VI. 206.

Helix reticulata, Pfr. (*Arionta*.) Am. Journ. Conch., VII. 177.

Helix Nickliniana, Pfr. (*Arionta*.) Am. Journ. Conch., VII. 177.

Helix Tryoni, Newc. (*Euparypha*) jaw, W. G. B. Am. Journ. Conch., I. 93, pl. vi. fig. 2-10.

Showing variation in number of ribs.

Helix Gossei, Ad. (*Coryda*.) Am. Journ. Conch., VII. 177. Lingual membrane only.

Helix aspera, Fer. (*Thelidomus*.) Am. Journ. Conch., VI. 204.

Helix notabilis, Shuttl. (*Thelidomus*.) Am. Journ. Conch., VII. 177. Lingual membrane only.

Helix pemphigodes, Pfr. (*Cysticopsis*.) Am. Journ. Conch., VII. 177. Lingual membrane only.

Helix tumida, Pfr. (*Cysticopsis*.) Ann. Lyc. N. H. of N. Y., IX. 283, fig. 3, lingual.

Jaw, different from generic description, figured in Am. Journ. Conch., VI. 203, fig. 2.

Helix loxodon, Pfr. (*Plagioptycha*.) Am. Journ. Conch., VII. 177.

Unlike the generic description, the jaw has a median projection, and is ribless.

Helix diaphana, Lam. (*Plagioptycha*.) Am. Journ. Conch., VII. 178. See last species.

Helix monodonta, Lea. (*Plagioptycha*.) Am. Journ. Conch., VII. 178. See last.

Helix Albersiana, Pfr. (*Plagioptycha*.) Amer. Journ. Conch., VII. 178. Jaw same as in last species.

Helix macroglossa, Pfr. (*Plagioptycha*.) Am. Journ. Conch., VII. 178. Jaw with median projection and no anterior ribs.

Helix varians, Mke. (*Polymita*.) Am. Journ. Conch., VI. 206, lingual.

Helix muscarum, Lam. (*Polymita*.) Am. Journ. Conch., VI. 204, pl. ix. fig. 4, 16.

Jaw ribless, lingual widely differing from the usual type of *Helix*.

Helix graminicola, Ad. (*Polymita*.) Amer. Journ. Conch., VII. 178.

Jaw different from generic description of *Helix* in having no anterior ribs—and in having a median projection to its cutting edge.

Helix crispata, Pfr. (*Eurycratera*.) Am. Journ. Conch., VII. 179.

Helix orbiculata, Fér. (*Dentellaria*.) Am. Journ. Conch., VI. 205, pl. ix. fig. 14. Jaw apparently costate.

Helix Isabella, Pfr. (*Dentellaria*.) Am. Journ. Conch., VII. 179. Jaw surely costate.

Helix dentiens, Fér. (*Dentellaria*.) Am. Journ. Conch., VII. 179. Jaw as in last.

Helix perplexa, Fér. (*Dentellaria*.) Ann. Lyc. N. H. of N. Y., X. 221. Jaw with traces of anterior ribs, but with a median projection to its cutting edge.

Helix Schroeteriana, Pfr. (*Pleurodonta*.) Am. Journ. Conch., VII. 179.

Lingual membrane alone examined.

Helix acuta, Lam. (*Pleurodonta*.) Am. Journ. Conch., VI. 204.

Helix excellens, Pfr. (*Caraculus*.) Am. Journ. Conch., VII. 180. Lingual membrane only examined.

Helix Bermudensis, Pfr. (*Caraculus*.) Ann. Lyc. N. H. of N. Y., X. 221.

The species shown to belong to the *Vitrininae*.

Helix fuscocincta, Ad. (*Leptoloma*.) Am. Journ. Conch., VII. 180. Jaw unlike generic description in having a median projection and no ribs.

Helix Phoenix, Pfr. (*Acavus*.) Am. Journ. Conch., VII. 180. Jaw with no anterior ribs.

(c.) *With jaw in separate pieces.*

Liguus virgineus, Lin. Am. Journ. Conch., VI. 209, fig. 3, 4, lingual membrane.

Liguus fasciatus, Müll. Am. Journ. Conch., VI. 211, pl. ix. fig. 6.

Orthalicus zebra, Müll. Am. Journ. Conch., VI. 212, pl. ix. fig. 2.

Orthalicus undatus, Brug. Am. Journ. Conch., VI. 213, pl. ix. fig. 10, 12.

(d.) *With jaw with supplementary upper plate.*

Succinea effusa, Shuttl. Am. Journ. Conch., VI. 213, pl. ix. fig. 15.

Succinea Nuttalliana, Lea. Ann. Lyc. N. H. of N. Y., IX. 282, fig. 1.

PULMONATA LIMNOPHILA.

Limnæa appressa, Say. Am. Journ. Conch., VII. 161, pl. xii. fig. 1, 2, 5.

Limnæa megasoma, Say. Am. Journ. Conch., VII. 162, pl. xii. fig. 3, 6.

Pompholyx effusa, Lea. Ann. Lyc. N. H. of N. Y., IX. 290, fig. 9.—Amer. Journ. Conch. VI. 312, pl. xviii.

Planorbis trivolvus, Say. Ann. Lyc. N. H. of N. Y., IX. 292, fig. 10.

Melampus bidentatus, Say. Ann. Lyc. N. H. of N. Y., IX. 286, fig. 7.

PECTINIBRANCHIATA.

Geomelania. Am. Journ. Conch., VII. 185, pl. xvii. fig. 7, 10.

Blandiella reclusa, Guppy. Am. Journ. Conch., VII. 185, pl. xvii. fig. 5.

Cyclotus stramineus, Rve. Am. Journ. Conch., I. 45, pl. v. fig. 1, 4. T. Bland. Jaw and teeth.

Megalomastoma cylindraceum, Chemn. Am. Journ. Conch., I. 45, pl. v. fig. 2, jaw. T. Bland.

Megalomastoma Antillarum, Sowb. Same as last, fig. 3, teeth. T. Bland.

Megalomastoma bituberculatum, Sowb. Am. Journ. Conch., VI. 213, fig. 6.

Tulotoma magnifica, Conrad. Ann. Lyc. N. H. of N. Y., IX. 293, fig. 11.

SCUTIBRANCHIATA.

Stoastoma pisum, Ad. Am. Journ. Conch., VII. 184.

Helicina occulta, Say. Ann. Lyc. N. H. of N. Y., IX. 287, fig. 8.—Am. Journ. Conch., VII. 29, pl. ii. fig. 6.

Helicina orbiculata, Say. Am. Journ. Conch., VI. 214, pl. ix. fig. 5.

From the observations we have catalogued above, it appears that the jaw cannot be depended upon as a generic character in the genus *Bulimus*, as constituted in the second edition of Die Heliceen. We have found it strongly ribbed, with ribs as described below in *Bulimulus*, ribless, and ribless with a decided median projection to its cutting edge. In *Limicolaria* the jaw is described with ribs, we find it ribless in one species. In *Bulimulus*, von Martens describes the jaw as composite. We have shown it to be in one single piece, though divided by delicate ribs into numerous plate-like sections. The jaw is also very thin and transparent. This form of jaw seems constant in *Bulimulus*. It is also found in *Cylindrella*, *Macroceramus*, *Amphibulima*, *Gæotis*, and even in *Helix* (*H. turbiniformis*). The tendency to an upper triangular median plate is more or less seen in this form of jaw—its greatest development being in *Cylindrella*.

In the genus *Helix* as constituted by von Martens, the jaw is said to be ribbed, but we have found every variety of jaw except that with an upper additional plate, and that with free imbricated plates as in *Orthalicus*. We believe, however, that the form of jaw is constant in all the species of each section or subgenus of

Helix. Thus we have found the jaw alike in all the species we have examined of *Patula*. So of *Sagda*, *Polygyra*, *Mesodon*, *Arionta*, *Stenotrema*, *Triodopsis*, *Plagioptycha*, *Polymita*, *Dentelaria*.

It appears to us, therefore, that we may hope to find a reliable generic character in the jaw, when the present subgenera, or some of them at least, are recognized as distinct genera. On account of the gradations in the ribs and median projection, we have elsewhere¹ suggested that for the purpose of grouping the genera into subfamilies, we may depend only upon the following distinctions in the jaw.

(a.) Jaw in one piece.

(b.) Jaw in separated, imbricated pieces.

(c.) Jaw in one piece with an upper accessory plate.

As regards the lingual dentition, it appears that the distinction, as far as the central and lateral teeth are concerned, is but slight between the various families and genera. The marginal teeth, however, give us two very distinct types, the aculeate and quadrate.

The former is found either unaccompanied by a jaw, or by its simplest form. Up to this date no instance is on record of aculeate marginal teeth together with a jaw complicated by anterior ribs, free imbricated plates, or an upper accessory plate. The presence of aculeate marginal teeth is usually (not always) indicated by a smooth, shining shell, with acute peristome. The shell, however, is not always reliable as an indicator of the form of marginal teeth, for we have shown the rough shells of several Mauritius species to have a lingual membrane with aculeate marginal teeth. It appears, therefore, that the shell alone will not indicate the generic position of some species.

The quadrate marginal teeth are accompanied by various forms of jaw. They are usually constant in shape in the various genera. Sometimes, however, we have met with unexpected variation—such as in *Macroceramus Gossei*, *Helix muscarum*, and a group of *Bulimulus* represented by *B. lalicinctus*.

The form of jaw with free, imbricated plates seems (excepting in *Punctum*) constantly accompanied by a peculiar form of quadrate teeth, as in *Orthalicus* and *Liguus*. To our surprise, however, we have detected a somewhat similar form of teeth in *Gæotis*,

¹ Ann. Lyc. N. H. of N. Y., X. 163.

whose jaw is like that of *Bulimulus*.¹ It seems, therefore, that the lingual dentition is less reliable as a generic character than the jaw, at least in cases where the aculeate marginal teeth are absent.

Finally, we are convinced that most satisfactory results will follow the patient investigation of the jaw and lingual dentition of the *Geophila*. Although we have in many cases proved the distinctions, which have been based on them, to be unreliable, we believe that a further accumulation of facts will lay the foundation of a natural and generally acceptable classification.

EXPLANATION OF PLATE I.

Fig. 1. The jaw of *Helix Newberryana* (see page 244).

Fig. 2. Genitalia of *Helix infumata*. See references to fig. 5, except 9, the duct of the genital bladder.

Fig. 3. Genitalia of *Helix Newberryana*. Same references as in 5, excepting 12, probably a rudimentary dart sac, for which see page 245. The names of the organs are the same as used by Dr. Leidy in the plates of Vol. I. of Dr. Binney's *Terrestrial Air-breathing Mollusks of the United States*.

We failed to detect any accessory gland of the epididymis. The epididymis is very long, convoluted in the lower half of its length, straight above. It runs free for a long distance outside the membrane which covers the oviduct, before entering into the liver, where it joins the testicle. The latter is imbedded in the liver, near its upper extremity. It is composed of several, apparently six, separated fasciculi of blind tubes. The vas deferens enters the penis about its middle, not at its end. The penis is small, cylindrical. There is no trace of lobuli in the ovary, but its under, concave surface is reticulated. The genital bladder is oval, its duct is long, free only for a short distance, then attached to the oviduct the whole length of the latter; at its base it becomes again free, and enters the vagina below the terminus of the oviduct. At about the same point, the vagina receives the mouth of a long, broad, rounded organ, (12 of fig. 3). This organ is hollow. Its use is unknown to us, it may be a dart sac, or a prostate gland.

¹ We are about publishing this in the *Ann. N. Y. Lyc. of N. H.*, 1873, X. 251, pl. xi. fig. 5.

The vagina is very long, the penis enters it at its lower extremity near the exterior opening of the genitalia.

For the sake of comparison, we have also given figures of the genitalia of two other Pacific subgenera, *Arionta* and *Aglaia*. In *Helix Townsendiana*, Lea (*Arionta*), see plate I. fig. 4, we detected the accessory gland of the epididymis (3), composed of several acini of different sizes. The genital bladder is lengthened oval (9), and differs greatly from that of *Helix Newberryana* in having a very short, stout duct. At the opening of the penis there is a decided enlargement, perhaps of the nature of a prepuce, or prostate. The vas deferens enters the penis below its apex. The retractor muscle is at the apex of the penis. There seems no accessory organ, the genitalia being reduced to their simplest type.

Of *Aglaia* we have examined two species, *H. fidelis*, Gray, and *H. infumata*, Gould. The genitalia of these are almost exactly similar. In neither have we detected any accessory gland to the epididymis. In both the penis is extended into a decided flagellum (15). The vas deferens (7) enters below the flagellate extension (15). The retractor muscle (6) is attached on the opposite side and still lower down. There is a well-marked prepuce (12). Opposite the entrance of the penis on the other side of the vagina, which is here considerably swollen, is a small sac-like organ (14), ending in a smoothly rounded cul-de-sac, of what use in the economy of the animal is unknown to us, unless it be a rudimentary dart sac. There was no appearance, however, of a dart within it. Just above this organ opens the stout duct of another organ (13), cylindrical, bluntly pointed, hollow, of a reticulated appearance. There is a contraction where this organ joins its duct, which is of about the same size. The two together are about as long as the penis with its flagellum, and stouter. No dart was noticed within this organ. It is, no doubt, a form of vaginal prostate, as described by Moquin Tandon. The genital bladder (9) is globular. Its duct is long, free in the upper half of its course. The oviduct, ovary, genital bladder, testicle, etc., of *H. infumata*, fig. 2, are not figured by us. They are as in *H. fidelis*, fig. 5, excepting the testicle, which is as in *H. Newberryana*.

Fig. 4. Genitalia of *Helix Townsendiana*, Lea. Same reference as in Fig. 5, excepting 3, the accessory gland of the epididymis.

Fig. 5. Genitalia of *Helix fidelis*, Gray.

1. Testicle.
2. Epididymis.
4. The prostate gland.
5. The sac of the penis.
6. The retractor muscle of penis.
7. The vas deferens.
8. The oviduct.
9. The genital bladder.
10. The exterior orifice of genitalia.
11. The ovary.
12. The prepuce.
13. Vaginal prostate.
14. Rudimentary dart sac?
15. The flagellum, which contains a capreolus.
16. The duct of the genital bladder.



W.G. BINNEY, DEL.

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with compliments of A. F. G.

NOTES

ON

AMERICAN LAND SHELLS

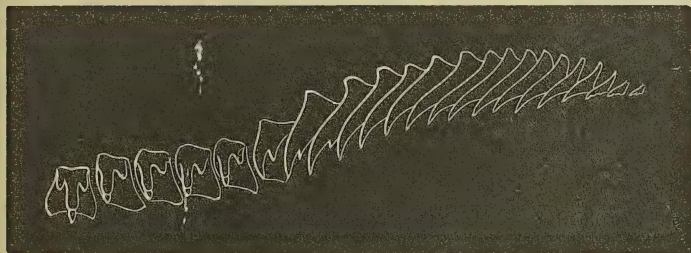
AND OTHER

MISCELLANEOUS CONCHOLOGICAL CONTRIBUTIONS.

VOL. II. PART III.

BY

W. G. BINNEY.



Lingual dentition of *Zonites arboreus*.

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ON THE JAW AND LINGUAL MEMBRANE OF NORTH AMERICAN
TERRESTRIAL PULMONATA.

BY W. G. BINNEY.

In his work on the "Terrestrial Air-breathing Mollusks of the United States," my father paid great attention to the jaws and lingual membranes, figuring those of all the species which he could obtain. In continuing my father's labors on the same subject, I have described and figured those of many other species. Thus, in a certain sense, it may be said that a great deal is known of these organs in our land shells. Unfortunately, however, these figures and descriptions have become of comparatively little value now that the study of this subject has assumed such importance. They do not give in sufficient detail the character of the individual teeth, however correct an idea they may give of the general arrangement of the teeth upon the membrane. I have, therefore, been induced to review the whole subject, and present it in a manner which will be of value as throwing light upon classification.

The following pages contain the result of my re-examination of the lingual membranes collected by me during the last thirty years. I regret that the collection is not more perfect, but there seems little chance of my making it more so, especially as to the rarer and more inaccessible species. I have decided, therefore, to publish at this time what material I have.

Before commencing my description, I will give some general remarks on the organs treated of in my paper, and on their value for the purpose of classification, and on the bibliography of the subject.

GENERAL REMARKS.

As many of my readers are quite unfamiliar with the subject, especially most of those who have so largely contributed specimens for examination, I will describe in detail the position of the organs and the method adopted for their study.

On holding up against the light an individual of *Helix thyroides* in one hand, and offering to him with the other some food (a piece of carrot is always acceptable), one can readily see with the naked

eye the two organs here treated of. Above the external opening of the mouth, through the transparent tissue of the head, is seen a small, arched, reddish, free instrument, which appears to rise and fall as if used in cutting off morsels of food. This is the jaw.

On the floor of the mouth is the lingual membrane, occupying about the position of the human tongue. Its color is too nearly the same as that of the head to afford any strong contrast, but, with close attention, it will be detected by its glistening silvery appearance, as it works backward and forward.

The use of the tongue seems to be to rasp the food and also to force it back into the œsophagus.

More detailed description, fully illustrated by figures, of the position of these two organs, will be found in the chapters on Special Anatomy in the first volume of the "Terrestrial Air-breathing Mollusks of the United States."

METHOD OF EXTRACTION.

On opening the head of *Helix thyroides* from above, one readily notices at the extreme anterior part, close against the outer integument, a prominent oval body. This is called the buccal mass. It is easily cut away from the animal, and will be found to contain both jaw and lingual membrane. They can be removed by fine scissors or knives from the buccal mass in the larger species, but in the smaller species, the method usually employed is putting the whole buccal mass in a watch crystal full of a strong solution of caustic potash. Allowing it to remain for several hours, the potash will destroy all of the buccal mass, and leave the jaw and lingual membrane perfectly clean and ready for examination. They remain attached, if the solution is not too strong, showing a connection between the two. They must first be well rinsed in clean water, in another watch crystal, before examination. Another more expeditious process is to place the whole buccal mass in a test-tube, with the solution of potash, and boil it for a few seconds over a spirit lamp. Pouring the contents of the test-tube into a watch crystal, the lingual membrane attached to the jaw will be readily seen by a pocket lens. If the species be very small, as *Paluta striatella* for instance, its whole body may be thrown into the solution. Still more minute species, as *Zonites milium* for instance, may be treated in this way: crush the whole shell between

two glass slides, wash away the particles of the broken shell in a few drops of water, still keeping the body of the animal on the slide; when clean, drop on it the caustic potash and boil it by holding the slide itself over the spirit lamp.

ON MOUNTING.

For the purpose of examination, the jaw and lingual membrane may be simply mounted in water and covered with thin glass. One must be sure to spread out the lingual membrane, not have its upper side down, and it will be well to cut it transversely in several places, as the teeth are beautifully shown, and often stand detached, on the edges of the cut.

For preservation for future study I hesitate to recommend any process, as I know of none which has been tried for a sufficiently long time. I have myself lost many specimens by imperfect mounting. Canada balsam, formerly used, ruins the membrane by rendering it too transparent. The glycerine mounting fluids, now in use, certainly preserve a membrane for several years, but they have not been tried many years.

ON THE JAW.

The jaw and lingual membrane, having been mounted, must now be examined under the microscope.

The jaw will be found to vary greatly in its characters in the different genera. It is either in one single piece (pl. XVI., fig. 1); in one single piece with an accessory quadrate piece attached to its upper margin; or in separate, detached pieces, free on their lower edges, usually soldered together into one single piece above (pl. XVI., fig. 13). It differs also in being with (pl. XVI., fig. 3), or without (fig. 6) a median beak-like projection to its cutting edge; also in its ends being more or less acuminate; but still more by the presence or absence of striæ or rib-like processes on its anterior surface. When present, the ribs are found in every degree of development, passing quite across the jaw and denticulating one or both margins (pl. XVI., fig. 8), or only developed on the lower portion of the jaw, and crenellating the lower margin. The ribs are often almost obsolete, or represented by wrinkles or coarse striæ. They are present on the anterior

surface of the jaw only, or on both anterior and posterior surfaces. They are distant, narrow, stout, few (fig. 8); or crowded, broad, stout, and numerous (fig. 14). Their number is within certain limits inconstant in the same species. They sometimes are very broad, and seem like separate plates soldered to the anterior surface of the jaw, or to be formed by a folding of the jaw upon itself (fig. 12). When this appearance of folding into plates is given, it will generally be found that the plait-like sections are actually separated by distinct, but delicate ribs. When this form of ribs is found, they are either vertical or inclined obliquely towards the median line of the jaw. Sometimes this last arrangement is developed to such a degree that the delicate ribs meet before reaching the bottom of the jaw, and a triangular compartment is left at the upper centre of the jaw, its base being upward (fig. p.). This form of jaw is usually thin and membranous.

When the jaw is striated and not ribbed, the striæ are vertical, or they converge towards the median line (fig. p.). There are often transverse striæ also, and transverse lines of re-enforcement (pl. XVI., fig. 3).

The upper margin of the jaw is often extended into a stout membranous attachment, apparently of the same material and consistency as the jaw itself, and showing the same continuity of structure by the striæ of the jaw extending into it without interruption. This is not the accessory quadrate plate mentioned above.

The jaw is found in every degree of consistency, from very thick to quite membranous and almost transparent.

The cutting margin of the jaw is smooth, crenellated, or denticulated. It is simply concave, or furnished with a more or less developed beak-like median projection.

In shape the jaw ranges from scarcely arcuate, long, low, to horseshoe-shaped, short, high.

It will be seen below that these peculiarities of the jaw, taken in connection with the characters of the lingual membrane, appear to furnish reliable characters for classification.

THE LINGUAL MEMBRANE.

In placing the lingual membrane under the microscope, we at once perceive that it is (at least in most of our genera) a long,¹ narrow, ribbon-like organ, whose whole surface is covered with numerous small tooth-like processes, whose reflected apices are pointed, the points directed towards the œsophagus, to which, as stated above, they serve to move the food, as well as to perform a rasp-like mastication. These teeth are arranged in two series of rows, one running longitudinally, the other transversely.

On careful examination it will be seen that all the teeth of each successive longitudinal row are of the same form,² but that there are several types of teeth in the different parts of each transverse row. Three of these types are found, the *central* tooth, the teeth on either side of the central, called *laterals*, and the teeth extending from the laterals to the outer margins of the membrane, called *marginals*. The change from the single central to the laterals is usually abrupt, but from the laterals to the marginals it is usually gradual, so that there are several teeth intermediate between the two, which may be called *transition* teeth. The transverse rows of teeth are similar on each side of the central tooth, so that it is necessary to figure only one-half of one transverse row with its central tooth to give an idea of the whole transverse row, or indeed, of the whole membrane, as all the longitudinal rows, as stated above, have similar teeth.

These transverse rows differ in the various genera as to their direction, either straight, oblique, or curving, or a combination of these directions.

Of the three types of teeth, central, lateral, and marginal, one or more may be wanting. Their number, however, is approximately constant in different individuals of the same species, so that, as a specific character, the count of the teeth on one transverse row is usually given; thus in *Zonites inornatus* I find about

¹ It is very broad in *Orthalicus Liguus*, some subgenera of *Achatinella*, some *Bulinuli*, etc.; in some subgenera of *Cylindrella* it is very narrow.

² Even in case of malformation this holds true. I have often found a misshapen, or otherwise abnormal tooth, repeated down the whole length of the membrane, or even that a tooth may be entirely wanting in its whole length.

23—1—23 teeth, that is, 23 teeth on each side of the central tooth, making 47 teeth in the entire transverse row.

The characters of the individual teeth vary greatly in the various genera, especially in some of the genera foreign to our limits. In most cases, however, there are two distinct types of teeth, the *quadrate* and *aculeate*. The former is shown in pl. III., fig. 12, *a*, *b*, *c*, *d*, is the portion of the tooth which rests upon the membrane; I have called it the *base of attachment*. It varies in its proportional length, and in the greater or less expansion of the lower¹ lateral angles. The upper margin of this base of attachment is broadly reflected; *e* marks the reflected portion, which I term the *reflection*. It is usually tricuspid, the *median cusp h* being much longer than the side *cusps f f*. These last are sub-obsolete in the species figured, but in figure 7 *a* of the same plate these side cusps are more fully developed. All the cusps are in most cases surmounted by distinct *cutting points*; *i* is the *median cutting point*, *g g* the *side cutting points*. These cutting points are not always present on the side cusps, and, even when present, are sometimes not readily detected. Indeed, this is the most difficult point of study of the whole membrane. The cusps and cutting points vary in development in the various species, and somewhat so in different portions of the same membrane.

The other type of tooth (pl. XVII., fig. 3 *b*), which I call *aculeate*, differs in not having a quadrate base of attachment, but usually one of a somewhat sole-like form. Its upper margin is not reflected, but from its whole surface springs a single large cutting point, usually thorn-shaped, but sometimes more spine-shaped. The apex of the cutting point is sometimes bifid, or even trifid, even in the same genus.

Of these two types, quadrate and aculeate are all the teeth now known. Of the quadrate type many and dissimilar forms are known, but all have the quadrate base of attachment.

The characteristics of central, lateral, and marginal teeth are given under each genus or subgenus.

¹ I use the term *upper* and *lower* to describe the figure I give of the base of attachment. More properly I should say *posterior* and *anterior* to describe their position on the membrane.

ON CLASSIFICATION.

The characters of the jaw, combined with those of the lingual membrane, furnish reliable bases of classification. They have been considered of various weight by different writers. I here propose to treat them as guides only to the greater division of the Pulmonata.¹ In grouping the various genera it will be necessary to include *all*, both American and foreign to America, in order to properly appreciate the value of this grouping.

Taking, therefore, the whole series of known terrestrial Pulmonata, the first grand division is based on the presence or absence of a jaw. Of the former are the following: *Testacella*,² *Daudebardia*,³ *Streptaxis*,⁴ *Rhytida*,⁵ *Diplomphalus*,⁶ *Strebelia*?⁷ *Glandina*,⁸ *Petenia*?⁹ *Spiraxis*?¹⁰ *Streptostyla*,¹¹ *Ravenia*?¹² *Streptosotele*,¹³ *Cæliaxis*?¹⁴ *Gonospira*,¹⁵ *Gibbus*?¹⁶ *Ennea*.¹⁷

All the above have aculeate marginal teeth; the lateral teeth are always absent; the centrals in some of the genera.

The following genera have quadrate marginal teeth: *Onchidium*,¹⁸ *Onchidella*,¹⁹ *Peronia*,²⁰ *Buchanania*?²¹

¹ I must not be understood to propose a system of classification. I merely place the genera into certain groups, independent of their divisions into families.

² Heynemann, Malak. Blatt. X., pl. II., fig. 5.

³ Goldfuss verh. Naturh. Vereins der preuss. Rheinl. und Westphalens, 13th year, 1856, pl. VI., fig. c. c¹.

⁴ Heynemann, Malak. Blatt. XV., pl. IV., fig. 2.

⁵ Semper, Nachr. der deut. Malak. Gesellschaft II., 102.

⁶ Fischer and Crosse, Journ. de Conch. XXI., 21, pl. III., fig. 8.

⁷ Jaw and dentition unknown.

⁸ See this paper.

⁹ Jaw and dentition not actually known.

¹⁰ Jaw and dentition not actually known; as restricted, the genus may be more correctly placed near *Stenogyra*.

¹¹ Fischer and Crosse, Moll. Mex., p. 16, pl. IV., fig. 2.

¹² Jaw and dentition not actually known.

¹³ Heynemann, Nachr. mal. Gesel. I. 20, 177, fig. 5.

¹⁴ Jaw and dentition not actually known.

¹⁵ Bland and Binney, Amer. Journ. Conch. V. 37, pl. XI. fig. 1, photographed.

¹⁶ No doubt like the last.

¹⁷ Heynemann, Nach. mal. Gesel. I. 20, 177, pl. XX., figs. 3, 4.

¹⁸ Bland and Binney, Ann. Lyc. N. H. of N. Y. X., p. 340, pl. XVI., figs. 3-5.

¹⁹ Heynemann, Malak. Blatt. X., pl. III., fig. 13.

²⁰ Quoy, Voy. de l'Astrolabe, pl. XII. ²¹ Jaw and lingual unknown.

The second grand division contains those genera having a jaw. In this division also we find some genera with aculeate, and some with quadrate, marginal teeth.

Of the former are: *Limax*,¹ *Ibycus*,² *Parmacella*,³ *Tennentia*,⁴ *Mariella*,⁵ *Parmarion*,⁶ *Dendrolimax*,⁷ *Phosphorax*,⁸ *Urocyclus*,⁹ [I know nothing of the position of *Othelosoma*, *Aspidorus*, and other problematical genera.] *Vitrina*,¹⁰ *Vitrinoidea*,¹¹ *Vitrinopsis*,¹² *Nanina*,¹³ and all the genera now recognized in its disintegration, *Stenopus*,¹⁴ *Vitrinoconus*,¹⁵ *Macrocyclis*,¹⁶ *Zonites*.¹⁷

The following genera have quadrate marginal teeth. They may be readily grouped by the character of their jaw, which is either in one single piece, in one single piece with an accessory upper quadrate piece, or in numerous pieces.

Those whose jaw is in one single piece may again be subdivided into several groups based on the absence, presence, and peculiarities of the ribs on their jaw. This division, however, is unsatisfactory, as these characters are not always well marked.

(a) Jaw without ribs: *Philomycus*,¹⁸ *Parmella*?¹⁹ *Oopelta*,²⁰ *Anaderus*,²¹ *Sagda*,²² *Patula*,²³ *Polymita*,²⁴ *Hemitrochus*,²⁵ *Helicodiscus*.²⁶

¹ See this paper.

² Heynemann, Malak. Blatt. X. 142, pl. I., fig. 3.

³ Semper, Phil. Archipell. 90.

⁴ Semper, l. c. 1, pl. VI., fig. 17.

⁵ Ib. 12.

⁶ Ib. 9, pl. VI., fig. 16.

⁷ Heynemann, Malak. Blatt. XV., pl. I., fig. 1.

⁸ Jaw and tongue not known.

⁹ Heynemann, Malak. Blatt. 1866, 70, pl. XI., as *Parmarion flavescens*.

¹⁰ See this paper.

¹¹ Semper, l. c. 85, pl. IX., fig. 33.

¹² Ibid. 86, pl. XI., fig. 26.

¹³ Ibid.

¹⁴ Bland, Ann. Lyc. N. H. of N. Y., VIII., 158, fig.

¹⁵ Semper, l. c., 91, pl. XI., fig. 27.

¹⁶ See this paper.

¹⁷ See this paper.

¹⁸ See this paper.

¹⁹ Jaw and lingual dentition unknown.

²⁰ Heynemann, Malk. Blatt. XIV., pl. I., 2.

²¹ Heynemann, Malk. Blatt. X., 138, pl. I., fig. 1.

²² Bland and Binney, Am. Journ. Conch. VI., 177.

²³ See this paper.

²⁴ Bland and Binney, Ann. Lyc. N. H. of N. Y., X., 341, pl. XVI., fig. 1.

²⁵ See this paper.

²⁶ See this paper.

Acavus, *Corilla*, *Caryodes*, *Panda*, *Labyrinthus*, *Caracollus*,¹ *Leucochroa*,² *Cysticopsis*?³ *Plagioptycha*,⁴ *Leptoloma*,⁵ *Anostoma*,⁶ *Anostomella*?⁷ *Tomigerus*? *Boysia*? *Plectostoma*? *Hypselostoma*?⁸ *Achatinella*,⁹ *Clausilia*,¹⁰ *Stenogyra*,¹¹ *Strophia*,¹² *Buliminus*,¹³ *Balea*,¹⁴ *Pupa*,¹⁵ *Vertigo*,¹⁶ *Ferussacia*,¹⁷ *Cæcilianella*,¹⁸ *Geostilbia*? *Azeca*? *Tornatella*?¹⁹ *Zospeum*?²⁰ *Holospira*,²¹ *Eucalodium*?²² *Cælocentrum*,²³ *Lithotis*,²⁴ *Rhodea*, *Megaspira*,²⁵ *Limicolaria*,²⁶ but one species has a ribbed jaw, *Achatina*,²⁷ *Pseudachatina*? *Perideris*? *Columna*?²⁸ *Bulimus* as now constituted has various forms of jaw.

(b) Jaw with decided stout ribs: *Arion*, *Ariolimax*, *Prophysson*, *Pallifera*, *Veronicella*, *Binneia*, *Hemphillia*, *Helix*,²⁹ *Geomolacus*,³⁰ *Letournexia*,³¹ *Peltella*,³² *Xanthonyx*,³³ *Simpulopsus*,³⁴ *Pfeif-*

¹ See Semper, l. c. No doubt other genera of disintegrated *Helix* will be found to be grouped here. I propose at present to remove from *Helix* all the species not having ribs upon their jaw.

² Bland and Binney, Ann. Lyc. Nat. Hist. of N. Y., X., 220.

³ Bland and Binney, Ann. Lyc. N. H. of N. Y., IX.

⁴ Proc. Ac. Nat. Sc. Phila. 1874, 56.

⁵ Ibid. 58.

⁶ Journ. de Conch., XIX., 261, pl. XI., fig. 4.

⁷ Jaw and dentition unknown.

⁸ Jaw and dentition unknown.

⁹ Bland and Binney, Ann. Cyc. N. H. of N. Y., X., 335, pl. XV., figs. 6, 7.

¹⁰ Troschel, Moquin-Tandon, Lehmann, etc.

¹¹ See this paper.

¹² See this paper.

¹³ But some species have ribs. See Moquin-Tandon, Lehmann, etc.

¹⁴ Moquin-Tandon, Moll. Fr., pl. XXV., fig. 6.

¹⁵ See this paper.

¹⁶ See this paper.

¹⁷ See this paper.

¹⁸ See this paper.

¹⁹ Unknown.

²⁰ Heynemann, Mal. Bl. X., pl. III., fig. 14. Jaw unknown.

²¹ See this paper.

²² See Crosse and Fischer, Journ. de Conch. 1870, pl. V., fig. 1.

²³ Jaw and dentition unknown.

²⁴ Binney, Proc. Phila. Ac. Nat. Sc. 1874, pl. V., fig. 3.

²⁵ Jaw and dentition unknown.

²⁶ Bland and Binney, Amer. Jour. Conch., VII., 181.

²⁷ Von Martens, ed. 2, p. 201.

²⁸ Jaw and dentition unknown.

²⁹ See this paper.

³⁰ Bland and Binney, Ann. of Lyc. of N. H. of N. Y., X., 309, fig.

³¹ Bourignat, Moll. nouv. et lit. VII. 201, pl. XXXIV., fig. 1-7.

³² Jaw apparently ribbed in Férussac's figure, pl. VII. A.

³³ Fischer and Crosse, Moll. Mex., pl. IX., figs. 15, 16.

³⁴ Shuttleworth, Diag., No. 6, p. 147.

feria,¹ *Berendtia*,² and, as stated above, some species now included in *Bulimus*, *Cochlostyla*, *Buliminus*, *Limicolaria*.

(c) Jaw with separate, delicate ribs, usually running obliquely towards the centre: *Gæotis*,³ *Amphibulima*,⁴ *Bulimulus*, *Cylindrella*, *Macroceramus*,⁵ *Pineria*,⁶ *Partula*.⁷

The genera whose jaw is in one piece with an accessory quadrate piece are *Succinea*,⁸ *Omalonyx*,⁹ *Hyalimax*,¹⁰ *Athoracophorus*.¹¹

The genera whose jaw is in separate pieces are *Orthalicus*, *Liguus*, and *Punctum*.¹² I have arranged the American genera in the same manner in the following pages.

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MORSE in *Journal of the Portland Society of Natural History*, 1864.

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LEHMANN. *Die lebenden Schnecken und Muscheln der Umgegend Stettins und in Pommern*. Cassel, 1873.

¹ Mörch, *Journ. de Conch.*, 1865, 385.

² Crosse and Fischer, *Journ. de Conch.* 1870, pl. V., fig. 11, 12.

³ Bland and Binney, *Ann. Lyc. N. H. of N. Y.*, Vol. X., pl. XI., figs. 1, 5-7.

⁴ *Proc. Phila. Ac. N. Sc.* 1874, pl. VIII., figs. 2, 5, 6. *Pellicula* is a synonym of this.

⁵ See this paper.

⁶ Bland and Binney, *Ann. N. Y. Lyc. N. H.*, X., 22.

⁷ Binney, *Ann. Lyc. N. H. of N. Y.*, XI. 45.

⁸ See this paper.

⁹ *Malak. Blatt.* X., pl. IV., fig. 5, a.

¹⁰ Fischer and Crosse, *Journ. de Conch.* XV., 218, pl. X., figs. 5, 7.

¹¹ Bergh, *verh. kais. kœnig. zoolog. botan. Gesell. in Wien*. XX. 844, pl. XII., fig. 2, 4, 5.

¹² See this paper.

GOLDFUSS. Verzeichniss der bis jetzt in der Rheinprovinz und Westphalen beobachteten Land- und Wasser-Mollusken, nebst kurzen Bemerkungen über deren Zungen, Krefer, und Liebesfeile. From Verhandlungen der naturhistorischen Vereins der preussischen Rheinlande und Westphalens. 13 Jahrgang. Bonn, 1856.

SEMPER Landmollusken. Reisen in Archipel der Philippinen. Wiesbaden, 1873.

HEYNEMANN. Einige Mittheilungen über Schneckenzenzen mit besonderer Beachtung der Gattung *Limax*. From Malakozoologischer Blätter, X. 1862.

VON MARTENS Die Heliceen von JOH. CHRIST. ALBERS. Zweite Ausgabe. Leipzig, 1860.

These are the principal works referred to. The references to shorter papers in various periodicals will easily be understood.

ON MY ILLUSTRATIONS.

I have endeavored to give a good view of the central, lateral, and marginal teeth of each species, with the transition teeth of many of the species. The portion of the membrane chosen is different in the various species of each genus or subgenus, in order that the variations in the form and development of cusps, and cutting points may be shown. Thus on pl. III. fig. 1, *b*, I have selected the part of the membrane where the marginal teeth have a very blunt cusp, while in fig. 4, *b*, they are shown much more graceful. It must constantly be borne in mind that on any one membrane the teeth vary considerably in regard to this point.

In illustrating the general arrangement of the teeth upon the lingual membrane in each genus or subgenus, I have used the woodcuts in the text prepared for my former works and papers, mostly by Mr. Morse, and a few by Dr. Leidy, prepared for my father's work. It must be remembered that these figures do not represent correctly the characters of the individual teeth.

I have also used in the text figures of the jaws of many genera and subgenera, prepared for the Land and Fresh Water Shells of North America, Part I. The jaws of the more recently described genera and subgenera I have myself drawn by camera lucida in pl. XVI.

ON THE VALUE OF THE JAW AND LINGUAL MEMBRANE FOR THE
PURPOSE OF CLASSIFICATION.

It is conceded by all recent students of land shells that for the larger divisions the presence or absence of a jaw, and the aculeate or quadrate form of marginal teeth are reliable characters.

The characters of the jaw and separate teeth of the lingual membrane have also been used in various ways for grouping the genera into families, etc., and even of grouping species into genera. I refrain from any discussion of their value for such purposes, simply because I believe our material is far too limited. It seems as if I can better employ my time in patiently accumulating new facts. I can, however, venture to say that the character of the jaw and teeth seems to be more constant in some genera than in others. It appears, for instance, that in some genera the presence or absence of lateral teeth is not a generic character, though in others it is.

The same may be said of the presence or absence of side cutting points to the centrals and laterals, and the greater or less development of their side cusps; also in the bifurcation or non-bifurcation of the cutting point of aculeate marginal teeth.

It will, I believe, be proved that certain genera are constantly characterized by peculiar form of teeth, while others have a considerable range of variation. I might, perhaps, add that when the genus is numerous in species, there is a much greater chance of finding a varying dentition. If this latter proves true, we shall be obliged to concede that there are certain types of teeth which may be found among species of some of the larger genera, though some of the smaller genera are much more, if not absolutely, restricted to one single type of dentition. I do not venture any further deductions at this time.

Before closing my paper I must return thanks to my many correspondents, who have furnished me specimens for examination during many years. I have already acknowledged their kindness while originally describing the jaw and lingual membrane of each species in the *American Journal of Conchology*, the *Annals of the Lyceum of Natural History of New York*, and the *Proceedings of the Academy of Natural Sciences of Philadelphia*. Most of

those papers¹ were published in connection with my friend, Mr. Bland, without whose aid I never could have had the material to study lingual dentition, especially in the interesting forms foreign to the United States. He has also shown great interest in the progress of the present paper.

Finally, I must acknowledge my many obligations to my young friend, Mr. A. Ten Eyck Lansing, for his most valuable assistance in the preparation of my paper. His observations of most of the lingual membranes, independent of my own, have saved me from many errors, and rendered my work much more reliable.

I will add that all the figures in the plates have been drawn by my own hand from the microscope itself, with the aid of the camera lucida.

BURLINGTON, N. J., Oct. 1874.

A complete catalogue of the species found in North America, from the extreme north to the Rio Grande and to San Diego, here follows. An account of their geographical distribution has been published by me in the Bulletin of the Museum of Comparative Zoology, vol. iii. No. 9, Cambridge, 1873.

The sign † is affixed to the name of species whose jaw and lingual membrane are unknown.

PULMONATA GEOPHILA.

OLEACINIDÆ.

†*Glandina Vanuxemensis*, Lea.
truncata, Gmel.
 †*decussata*, Desh.

†*Glandina bullata*, Gld.
 †*Texasiana*, Pfr.

HELICIDÆ.

VITRININÆ.

Macrocyclus Vancouverensis, Lea.
 †*sportella*, Gld.
concava, Say.

Macrocyclus Voyana, Newc.
Duranti, Newc.

¹ A complete list of all these papers may be had of the American Naturalist Agency, Salem, Mass.

Zonites capnodes, W. G. B.
fuliginosus, Griff.
friabilis, W. G. B.
caducus, Pfr.
lævigatus, Pfr.
demissus, Binn.
ligerus, Say.
intertextus, Binn.
†*subplanus*, Binn.
inornatus, Say.
sculptilis, Bland.
Ellioti, Redf.
†*cerinoideus*, Anth.
cellarius, Müll.
†*Whitneyi*, Newe.
nitidus, Müll.
arboreus, Say.
viridulus, Mke.
indentatus, Say.
limatulus, Ward.
minusculeus, Binn.
milium, Morse.
Binneyanus, Morse.
ferreus, Morse.
†*conspicuosus*, Bland.

Zonites exiguus, Stimpson.
†*chersinellus*, Dall.
capsella, Gld.
fulvus, Drap.
†*Fabricii*, Beek.
Gundlachi, Pfr.
†*Stearnsi*, Bl.
*
gularis, Say.
suppressus, Say.
lasmodon, Phillips.
significans, Bland.
internus, Say.
multidentatus, Binn.
Lansingi, Bland.
Vitrina limpida, Gould.
†*Angelicæ*, Beek.
Vitrina Pfeifferi, Newe.
exilis, Mor.
Limax maximus, Lin.
flavus, Lin.
agrestis, Mull.
campestris, Binn.
Hewstoni, J. G. Cooper.
Ingersolli, W. G. B.

HELICINÆ.

*

Patula solitaria, Say.
strigosa, Gld.
Cooperi, W. G. B.
Hemphilli, Newe.
Idahoensis, Newe.
†*Haydeni*, Gabb.
alternata, Say.
Cumberlandiana, Lea.
†*tenuistriata*, Binn.
perspectiva, Say.
striatella, Anth.
†*pauper*, Mor.
†*Horni*, Gabb.
asteriscus, Morse.
†*incrustedata*, Pfr.
vortex, Pfr.
Hemitrochus varians, Mke.
Tebennophorus Caroliniensis, Bosc.
†*Holospira Roemeri*, Pfr.

Holospira Goldfussi, Pfr.
Helicodiscus lineatus, Say.
Ferussaccia subcylindrica, L.
Cæcilianella acicula, Müll.
Stenogyra decollata, Linn.
subula, Pfr.
†*octonoides*, Ad.
†*gracillima*, Pfr.
Pupa muscorum, Linn.
†*Blandi*, Morse.
†*Hoppii*, Müll.
†*variolosa*, Gld.
pentodon, Say.
†*decora*, Gld.
†*corpulenta*, Morse.
†*Rowelli*, Newe.
†*Californica*, Rowell.
fallax, Say.
†*modica*, Gld.

†*Pupa Arizonensis*, Gabb.
 †*hordeacea*, Gabb.
 †*armifera*, Say.
 †*contracta*, Say.
rupicola, Say.
corticaria, Say.
 †*pellucida*, Pfr.
 †*borealis*, Mor.

Arion fuscus, Müll.

†*foliolatus*, Gld.

Ariolimax Columbianus, Gld.

Californicus, J. G. Cooper.

Hemphilli, W. G. B.

niger, J. G. Cooper.

Andersoni, J. G. Cooper.

Prophysaon Hemphilli, Bl. and Binn.

Binneia notabilis, J. G. Cooper.

Hemphillia glandulosa, Bl. and Binn.

Pallifera dorsalis, Binn.

Wetherbyi, W. G. B.

Gonostoma Yatesi, J. G. Cooper.

Strobila labyrinthica, Say.

Hubbardi, Brown.

Polygyra auriculata, Say.

uvulifera, Shuttl.

auriformis, Bld.

†*Postelliana*, Bld.

espiloca, Rav.

†*avara*, Say.

ventrosula, Pfr.

†*Hindsii*, Pfr.

Texasiana, Moricand.

†*tridonto des*, Bld.

Mooreana, W. G. Binn.

†*tholus*, W. G. Binn.

†*hippocrepis*, Pfr.

fastigans, L. W. Say.

†*Jacksoni*, Bld.

Troostiana, Lea.

Hazardi, Bld.

†*oppilata*, Moricand.

†*Dorfeuilliana*, Lea.

†*Ariadnæ*, Pfr.

septemvolva, Say.

cereolus, Muhlf.

†*Carpenteriana*, Bld.

Febigeri, Bld.

Vertigo Gouldi, Binn.

Bollesiana, Morse.

†*milium*, Gld.

ovata, Say.¹

ventricosa, Morse.

†*simplex*, Gld.

Strophia incana, Binn.

*

Polygyra pustula, Fér.

†*pustuloides*, Bld.

leporina, Gld.

Polygyrella polygyrella, Bld. and J. G. Cooper.

Stenotrema spinosa, Lea.

†*labrosa*, Bld.

†*Edgariana*, Lea.

Edwardsi, Bld.

barbigera, Redf.

stenotrema, Fér.

hirsuta, Say.

†*maxillata*, Gld.

monodon, Rack.

germana, Gld.

Triodopsis palliata, Say.

obstricta, Say.

appressa, Say.

inflecta, Say.

Rugeli, Shuttl.

tridentata, Say.

Harfordiana, J. G. Cooper.

fallax, Say.

†*introferens*, Bld.

Hopetonensis, Shuttl.

†*vultuosa*, Gld.

loricata, Gld.

Mesodon major, Binn.

albolabris, Say.

†*divesta*, Gld.

multilineata, Say.

Pennsylvanica, Green.

Mitchelliana, Lea.

elevata, Say.

Clarki, Lea.

†*Christyi*, Bld.

exoleta, Binn.

Wheatleyi, Bld.

¹ *V. tridentata*, Wolf, is synonymous with this.

Mesodon dentifera, Binn.
Roëmeri, Pfr.
Wetherbyi, Bland.
thyroides, Say.
clausa, Say.
Columbiana, Lea.
Downieana, Bld.
†*Lawi*, Lewis.
†*jejuna*, Say.
Mobiliana, Lea.
devia, Gld.¹
profunda, Say.
Sayii, Binn.

Acanthinula harpa, Say.
Vallonia pulchella, Mull.
Fruticicola hispida, L.
†*rufescens*, Penn.
Dorcasia Berlandieriana, Mor.
griseola, Pfr.
Aglaja fidelis, Gray.
infumata, Gld.
†*Hillebrandi*, Newc.
Arionta arrosa, Gld.
Townsendiana, Lea.²

Cylindrella Poeyana, Pfr.
†*jejuna*, Gld.
†*Macroceramus Kieneri*, Pfr.
Gossei, Pfr.
†*Bulimulus multilineatus*, Say.
†*Dormani*, W. G. B.

Arionta tudiculata, Binn.
Nickliniana, Lea.
Ayresiana, Newc.
redimita, W. G. Binn.
†*intercisa*, W. G. Binn.
Kelletti, Fbs.
Stearnsiana, Gabb.
exarata, Pfr.
ramentosa, Gld.
†*Californiensis*, Lea.
Carpenteri, Newc.
†*Mormonum*, Pfr.
sequoicola, J. G. Cooper.
Diabloensis, J. G. Cooper.
Traski, Newc.
†*Dupetithouarsi*, Desh.
ruficincta, Newc.
facta, Newc.
†*Gabbi*, Newc.

Glyptostoma Newberryana, W. G. Binn.
Euparypha Tryoni, Newc.
Tachea hortensis, Müll.
Pomatia aspersa, Müll.

*

†*Bulimulus Marielinus*, Pfr.
†*Floridanus*, Pfr.
†*patriarcha*, W. G. B.
alternatus, Say.
†*Schiedeanus*, Pfr.
dealbatus, Say.

ORTHALICINÆ.

Liguus fasciatus, Mull.
Orthalicus zebra, Mull.

Orthalicus undatus, Brug.
Punctum minutissimum, Lea.

SUCCININÆ.

†*Succinea Haydeni*, W. G. B.
†*retusa*, Lea.
Sillimani, Bld.
ovalis, Gld. not Say.
†*Higginsii*, Bld.
†*Haleana*, Lea.
†*Mooresiana*, Lea.
†*Grosvenori*, Lea.
†*Wilsoni*, Lea.
†*Concordialis*, Gld.

†*Succinea luteola*, Gld.
lineata, W. G. Binn.
avara, Say.
Stretchiana, Bld.
†*Verilli*, Bld.
†*aurea*, Lea.
†*Groënlandica*, Beck.
obliqua, Say.
Totteniana, Lea.
campestris, Say.

¹ *H. Mullani* is a variety of this.

² *H. ptychoptora*, Brown, is a variety of this.

†*Succinea Hawkinsi*, Bld.
 †*rusticana*, Gld.
Nuttalliana, Lea.

†*Succinea Oregonensis*, Lea.
effusa, Shuttl.
 †*Salleana*, Pfr.

VERONICELLIDÆ.

Veronicella Floridana, Binn.

†*Veronicella olivacea*, Stearns.

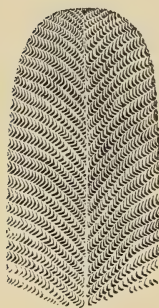
A. *Jaw absent.*

Family OLEACINIDÆ.

Genus **GLANDINA**, Schum.

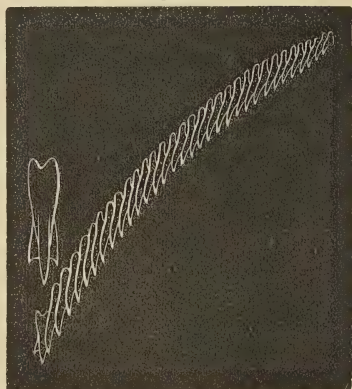
Lingual membrane narrow, with chevron-shaped rows of uniform, aculeate, separated teeth; central tooth with a long, slender,

Fig. 1.



Lingual membrane of *G. truncata*.

Fig. 2.



Lingual dentition of *Glandina truncata*.

straight base of attachment, with incurved sides, and with inferior lateral slightly expanded angles, and with the upper margin reflected and extended into a long, slender, acutely pointed cusp. There are no lateral teeth, the balance of the membrane being composed of marginal teeth of the pure aculeate form.

Each row of teeth on either side of the median line curves first backward, with the teeth rapidly increasing in size as they pass outwards, and then forwards as the teeth gradually again become smaller; giving an irregularly crescentic shape to the half row of teeth. This is shown particularly in *Gl. Albersi* and *G. rosea*, less so in *Gl. truncata*. The central tooth was overlooked by Wyman, Leidy, and other of the earlier investigators. It has

since been detected in *Gl. truncata*,¹ *rosea*,² *algira*,³ *Sowerbyana*,⁴ *plicatula*,⁵ *fusiformis*,⁶ *Albersi*;⁷ in *semitarum*,⁸ *Phillipsi*⁹ of the subgenus *Varicella*; also *solidula*¹⁰ of subgenus *Oleacina*. This central tooth is rather difficult to study, being on a different plane than the other teeth, and apparently much less developed. Its cusp is generally simple, long, and narrow; but in *G. rosea* it has a decided blunt cutting point, and in *G. semitarum* it has a long, slender, cutting point.

The side teeth are all of the purely aculeate type; the base of attachment is long, narrow, incurved at sides, gradually rounded above, expanded and bluntly truncated below, the general outline being somewhat like that of the sole of a shoe. From this base of attachment springs a large aculeate cusp. These side teeth are like the marginals in *Zonites*, *Limax*, etc.; they may therefore be called marginal teeth, and the lateral teeth, usually present in the *Vitrininae*, may be said to be entirely wanting.

As stated above, the marginal teeth increase rapidly in size for a short distance from the median line, and then gradually decrease in size, as they pass off laterally, the last tooth being still smaller than the first.

Glandina truncata has 32—1—32 teeth in each row. I have shown in plate I., fig. 1*a*, the central and first three marginals; *b* is the twentieth marginal; *c*, the last tooth. Fig. *a* and *c* show the teeth as seen from below, thus giving a perfect view of the bases of attachment. Fig. *b* is a strictly profile view. The eighth tooth seems to be the largest. The central tooth I find great difficulty in studying. It appears to have a simple, long, slender base of attachment, truncated above and below with slightly expanded lateral angles. The sides are somewhat incurved, giving the tooth the appearance of a simple modification of the base of attachment of the marginals. The figure (2) by Morse, copied

¹ See L. and Frw. Shells, I., fig. 6.

² Amer. Journ. Conch., V. 202, fig. 1.

³ Fischer and Crosse, J. de C. XVI. 234, 1868; Moll. Mex. et Guat., pl. IV. fig. 10.

⁴ Same, Moll. Mex. et Guat. 73, pl. IV. figs. 6-9.

⁵ Same, p. 73.

⁶ Same, p. 73.

⁷ L. and Frw. Shells, I., fig. 10, p. 19.

⁸ Proc. A. N. S. Phil. 1874, 49.

⁹ Same.

¹⁰ Ann. Lyc. N. H. of N. Y., X. 347.

above, gives a better illustration of this central tooth than is shown in my plate. I have lately verified it in fine specimens collected by myself in Florida.

In illustrating the dentition of this genus, I have given fig. 1, copied from Dr. Leidy's figure in Terr. Moll. U. S., to show the general arrangement *en chevron* of the rows of teeth. Fig. 2 by Morse, copied from L. and Frw. Sh. N. A., I., gives one-half of one transverse row of teeth, with the central tooth. Fig. 1 of my plate is intended to show the shape of the individual teeth: *a* gives the central with adjacent marginals; *b*, the twentieth marginal in profile; *c*, the thirty-second and last marginal.

I have not had an opportunity of examining the lingual membrane of *G. bullata*, *Texasiana*, *decussata*, or *Vanuxemensis*.

B. Jaw present.

Family HELICIDÆ.

This family may be divided by the character of its jaw in connection with that of its dentition into several subfamilies, *Vitrinina*æ, *Helicina*æ, *Orthalicina*æ, *Succinina*æ. The characteristic of each will be given below.

a. Jaw in one single piece; marginal teeth aculeate. VITRININÆ.

Genus MACROCYCLIS, Beck.

Jaw crescentic, ends sharply pointed, anterior surface striated; cutting margin smooth, with a median projection. I have examined the jaw of *M. Vancouverensis* (see fig. 3, copied from L. and Frw. Sh., I.), *concava*, *Duranti*, *Voyana*, and in the West Indian species, *M. Baudoni*,¹ Petit, and *M. euspira*, Pfr.

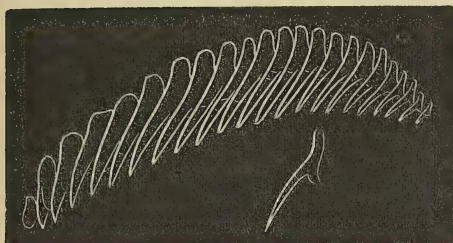


The general arrangement of the lingual membrane of *Macrocyclus* is the same as I have described above for *Glandina*.

There are 32 rows in one lingual examined of *M. Vancouverensis*. The rows of teeth are arranged *en chevron*. Each row is

¹ See Am. Journ. Conch. VII. 175; Ann. Nat. Hist. N. Y., X. 305.

Fig. 4.

Lingual dentition of *Macrocyclus Vancouverensis*.

divided by the median line into two irregular crescents, the teeth rapidly increasing and curving in a backward direction, and then gradually decreasing in size and curving forward. In *M. Vancouverensis* the sixth tooth is the largest. One of these subcrescentic

rows is shown in fig. 4, copied from L. and Frw. Sh., I., drawn by Morse. This figure, however, must not be used to judge of the shape of the separate teeth, better shown in plate I. The teeth of *Macrocyclus*, as also of *Glandina*, are separated, not crowded, as in the *Helicinæ*. The central tooth is seen with some difficulty by the microscope. I am confident, however, that I have drawn it correctly for the various species. In *M. Vancouverensis* (pl. I., fig. 4), the base of attachment is small, triangular, the apex pointed backward, the angles bluntly rounded, somewhat incurved at base, and bears a delicate, simple, short, slender cutting point, reaching from about its centre to near its base. This cutting point was not figured by Morse (see above fig.), and, indeed, was observed by me only on a few of the central teeth, and then with difficulty. In *M. concava* (pl. I., fig. 3) the central tooth has a larger base of attachment, the apex of the triangle is truncated and incurved, the base is more incurved, the outer lower corners more expanded and pointed, the cutting point more developed, with distinct lateral expansions like very slightly developed subobsolete side cusps. In *M. Voyana* (pl. I., fig. 5), the central tooth has a long, narrow, quadrangular base of attachment, incurved above, below, and at sides, and bears near its base three small, sharp cutting points, the median the largest; there seems to be no distinctly developed cusps bearing these cutting points. In *M. Duranti* the central tooth has a base of attachment somewhat like that of *M. Vancouverensis*, but longer, and with incurving sides; the cutting point is the same. I have not examined the lingual membrane of *M. sportella*, which may be merely a variety of *Vancouverensis*. The other species mentioned above are readily distinguished one from another by the form of their central teeth.

I may here mention that Tryon (Am. Jour. Conch., II. 246) erroneously includes in *Macrocyclus* a true species of *Zonites*, *Z. Elliotti*, characterized by caudal mucous pore, parallel longitudinal furrows above the margin of the foot, and the presence of perfect lateral teeth.

The side teeth of *Macrocyclus* at first sight, especially when seen from below, appear to be of the purely aculeate type, as the marginals in *Zonites* and *Limax*. From this, one is inclined to consider them all as marginals, and to declare that no true lateral teeth exist, thus making *Macrocyclus* to agree with *Glandina* in this particular also. A more careful study shows us that the teeth nearest the median line are modified from the aculeate type, though they do not have the distinct form of the laterals of *Zonites*, with decided cusps and cutting points. They seem rather to represent those teeth of *Zonites* which show the transition from the laterals to the marginals (see pl. II., fig. 2, the second lateral tooth of *Z. lævigatus*). It may be said, therefore, that the lateral teeth are entirely wanting in *Macrocyclus*, the first side teeth being laterals in the transition state, the balance being pure marginals. (See, however, *M. euspira*, below, which has a lingual membrane of *Glandina*.) The base of attachment of these transition teeth is like those of the marginals, i. e., sole-like, except that the lower lateral expansions are more developed and angular, and in *concava* and *Voyana* the lower edge is excurved rather than incurved. The cusps are long and slender, lengthened into cutting points; the teeth are unsymmetrical by the greater development of the outer subobsolete side cusps, both of these cusps being distinctly indicated by expansion. In *M. Vancouverensis* there is apparently a small sharp side point on the inner side of the cusp. I am not certain of its character, and have not ventured to figure it, excepting on the second tooth in fig. 4a. This process is seen on the first six teeth only. The balance of the teeth beyond the transition teeth in all the species are marginals of the pure aculeate type. They vary in sharpness in different parts of the same membrane, as will be seen by comparing my figure 4b of *M. Vancouverensis* with the marginals in profile given by Morse (see above fig. 2). In *M. Duranti* the extreme marginals are large in comparison with those of the other species.

In studying my figures, it must be remembered that fig. 3a, 5a, and 4c are drawn as seen from above, to show the form of the

cusps. The other figures are drawn from below, to show the base of attachment.

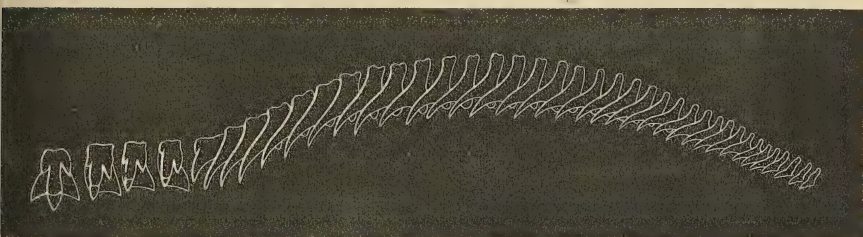
M. Vancouverensis, drawn by Morse, has 22—1—22 teeth, two other membranes examined by me gave 24—1—24, one other 18—1—18. *M. concava* has given 20—1—20, 23—1—23, and 25—1—25. Of *M. Duranti* I have counted but one membrane having 18—1—18. A single membrane of *M. Voyana* had 24—1—24 teeth.

To sum up the characters of the dentition of *Macrocyclus* it may be said to be intermediate between *Glandina* and *Zonites*, differing from the former in the presence of the transition teeth from true laterals to true marginals, differing, however, from the latter by the absence of true lateral teeth.

Genus ZONITES, Montf.

In the preceding genus *Glandina* we found only the aculeate form of teeth or pure marginals; in *Macrocyclus* we found in addition to these marginals a few showing a modification of this type, being the transition teeth from marginals into laterals. In the present genus, *Zonites*, we find for the first time the lateral teeth in their full development. Thus we have the three forms of teeth, centrals, laterals, and marginals, all present, and apparently a generic characteristic. It will be noticed, however, that in *lævi-*

Fig. 5.



General view of dentition of *Zonites indentatus*.

*gatus*¹ (pl. II., fig. 1, 2) there is no perfect lateral, the first tooth showing a decided modification or transition into the marginals. Thus we cannot say that in all species of *Zonites* there are pure lateral teeth. It will be seen below that in some species the number of laterals is reduced to two.

¹ See also *collarius*.

I give in fig. 5 a general view of the arrangement of the teeth in *Zonites*.¹ The centrals have a base of attachment longer than wide, subquadrate, with lateral expansions at the corners of the lower margin. The reflected portion varies in size in the various species, from highly developed in *viridulus* (pl. XVII., fig. 6) and others, to slightly developed in *lasmodon* (pl. III., fig. 7) and others; in the latter case resembling the short reflection of *Vitrina*. The reflection always bears a more or less developed central cusp, generally reaching to or beyond the lower margin of the base of attachment, and always bearing a distinct cutting point, which last, like the cusp, is usually slender, and projects over the tooth of the adjoining transverse line. The side cusps of the reflected portion of the tooth are usually subobsolete, but they are distinctly developed in *Z. lasmodon* (pl. III., fig. 7), *suppressus* (pl. XVII., fig. 11), *Gundlachi* (pl. III., fig. 10), *capsella* (fig. 4), *gularis* (fig. 1), *arboreus* (pl. XVII., fig. 4), *cellarius* (pl. II., fig. 3), *lævigatus* (fig. 1, 2), *significans* (pl. XVII., fig. 10), *ferreus* (pl. XVII., fig. 9), *viridulus* (pl. XVII., fig. 6), *nitidus* (pl. XVII., fig. 7), *fulvus* (pl. XVII., fig. 5), *miliun* (pl. XVII., fig. 8). On the side cusps are distinctly developed cutting points in all the species I have examined, excepting *lævigatus* and *cellarius*, in which I find no trace of cutting points. These points when present vary in development in the various species, generally disposed to be triangular and somewhat aculeate in form, thus bearing a resemblance to the cusp of the marginal teeth. The greatest development of these cutting points is seen in *Z. capnodes* (pl. II., fig. 6; pl. III., fig. 12). I have given on pl. III., fig. 12, an enlarged view of a central in *Z. capnodes*; *a b c d* gives the base of attachment, *e* the reflected portion of the tooth, *f f* the subobsolete side cusps, *h* the median cusp, *i* the cutting point of the median cusp, *g g* the cutting points of the side cusps. The general outline of the central tooth is graceful and slender as compared with the other genera, except *Limax* and *Vitrina*.

The lateral teeth in *Zonites* are of the same type as the central but are rendered unsymmetrical (as usual in the land shells) by, the suppression of the inner, lower, lateral expansion of the base of attachment and the inner side cusp and cutting point. It is

¹ The characters of the separate teeth of this species are better shown in pl. XVII., fig. 3.

only in *Z. Gundlachi* (pl. III., fig. 10) that I have observed the inner side cutting point, and in this species, even, the lateral teeth are still sufficiently unsymmetrical to be readily distinguished from the centrals; in *Z. Binneyanus* there is also a kind of inner cutting point. As mentioned above, the number of these lateral teeth varies in the respective species, and is so nearly constant as to be, I believe, a good specific character. I find, however, some difficulty in deciding in all cases where the true laterals end and the transition teeth commence, so gradual is the change in some species. Of two linguals of *Z. intertextus* examined, I found one to have 12, the other 14, perfect laterals. The number of lateral teeth in the different species is given below.

The teeth forming the gradual change from laterals to marginals are best illustrated in the case of *Z. lævigatus* (pl. II., fig. 2), the first four side teeth being transition teeth. As already stated above, this species wants entirely the perfect laterals. In *Z. cellarius* (pl. II., fig. 3) the two transition teeth have an inner lateral spur near the top of the cusp. The only lateral of this species has also peculiarities in its form easily seen in the figure, but difficult of description.

The marginal teeth of *Zonites* are quite like those of *Glandina* and *Macrocyclus* (see above). The curve of the transverse rows, the rapid increase and gradual decrease in size as they pass off laterally, is shown in pl. II., fig. 1, 3, and in the several wood-cuts I have given. The number of marginal teeth in each species examined is given below; it must be borne in mind, however, that the number is not constant in any given species, though the range of variation in number seems limited in the respective species. Thus, though I have found a slight difference in the count of teeth of *Z. inornatus*, I have every reason to believe I shall never find it to have as many teeth as in *Z. fuliginosus*. It appears, therefore, that the count of teeth has a decided specific value, at least in most cases.

The rapid increase and subsequent gradual decrease in size of the teeth as they pass off laterally, though it appears usually a generic character, is somewhat modified in some species. Thus in one lingual membrane of *Z. intertextus* examined I find a much more gradual and regular decrease from the first to the last marginal tooth.

The marginal teeth in *Zonites*, and, indeed, all the *Vitrininæ*, are

more separated than in *Helix*, and the separate rows are more widely removed the one from the other, especially near the outer margin of the membrane.

Though the simple aculeate form of marginals seems a generic character in *Zonites*, we find the marginals bifid in *Z. fulvus* (pl. XVII., fig. 5), and bifid or even trifid in *Z. Gundlachi* (pl. III., fig. 10), also for the first four marginals in *milius*. This character reminds us of *Vitrina* (see below); *Vitrinoconus* (Semper, Phil. Archip., 91); *Vitrinoidea* (Ibid., p. 85); *Vitrinopsis* (Ibid., p. 86), and the numerous genera of disintegrated *Nanina*; also some species of *Limax*. The first marginals of *Z. exiguus* have a side spur.

Taking the general characters of dentition into consideration *Zonites* is nearest allied to *Limax* among our genera, but in the latter the marginals are generally more slender or spine-like, and have a less sole-like base of attachment.

The approximate count of teeth in the various species now follows:—

Zonites capnodes (pl. III., fig. 12; pl. II., fig. 6) has 66—1—66 teeth, with 9 perfect laterals on each side the median row. Another specimen gave 46—1—46 teeth, with 70 rows of teeth in all.

Z. fuliginosus (pl. II., fig. 7) gave 87 rows of 64—1—64 teeth. Another specimen 57—1—57. Both linguals have 4 perfect laterals. Fig. 6 gives the eighth marginal from the outer edge.

Z. friabilis (pl. II., fig. 4) has 57—1—57 teeth with 6 laterals. Fig. 6 gives the extreme marginals of two adjacent rows.

*Z. caducus*¹ is known only by the description and figure of Fischer and Crosse (Moll. Mex. et Guat. 149, pl. VIII., fig. 13-16). There are 75—1—75 teeth with 5 laterals.

Zonites lævigatus (pl. II., fig. 1, 2) is peculiar in having no cutting points to the side cusps of the central teeth, and no perfect lateral teeth. I found in one specimen 28 rows of 19—1—19 teeth. Another specimen had 17—1—17 teeth. One-half of one transverse row with the central tooth is figured on pl. II., fig. 1. A more enlarged view of a portion is given in fig. 2.

¹ I will here mention that Semper, Archip., Phil. 78, pl. III., fig. 27; pl. V., fig. 21, figures the genitalia, jaw, and dentition of a *Zonites* from Tennessee, which he refers to *Z. lucubratus*, Say. I do not know what species he had before him. *Z. lucubratus* is not found in Tennessee. See Ann. N. Y. Lyc. N. H., pl. XI., fig. 24.

Z. demissus (pl. III., fig. 6, *b* is the 15th tooth) has 45—1—45 teeth, with 15 laterals. My specimen was one of the large East Tennessee form, called *Z. acerrus* by Dr. Lewis. The typical form from near Mobile has, however, a perfectly similar dentition.

Z. ligerus (pl. III., fig. 11, *b* is the 18th tooth; *c*, a profile of one nearer the central line). Teeth 38—1—38 with 14 laterals.

Z. intertextus (pl. III., fig. 8, *b* is from near the outer margin). I find difficulty in counting the teeth on one specimen examined by me, but I believe there are 61—1—61. There are 12 perfect laterals. Another specimen has 55—1—55 with 12 laterals

Z. subplanus, not examined.

Z. inornatus (pl. II., fig. 5, *b* is the 21st tooth). One specimen had 37 rows of 23—1—23 teeth. Another had 26—1—26. Both had only two perfect laterals.

Z. sculptilis (pl. III., fig. 2, *b* are extreme marginals) 40—1—40 teeth with 4 perfect laterals.

Z. Elliotti (pl. III., fig. 5, *b* an extreme marginal) 32—1—32 teeth with 6 perfect laterals.

Z. cerinoideus, not examined.

Z. cellarius (pl. II., fig. 2, one-half of one transverse line with the median tooth) 14—1—14 teeth. There can hardly be said to be one perfect lateral. For the other abnormal characters of this lingual membrane see p. 163. The figures of dentition of the foreign form (by Lehmann, Lindström, etc.) agree with mine.

Z. Whitneyi, not examined.

Z. nitidus. See Lehmann, Lebenden Schnecken, etc. p. 72, pl. X., fig. 23, for description and figure of the European form. In a specimen from Baldwin County, Alabama, furnished by Dr. E. R. Showalter, I find 25—1—25 teeth with 5 laterals—(pl. XVII., fig. 7, *b* is an extreme marginal.) Lehmann gives 28—1—28.

The specimen examined had the dart-sac and dart described in the European form.

Z. arboreus. Morse gives 82 rows of 21—1—21 teeth each. My specimen (pl. XVII., fig. 4, *b* is an extreme marginal) has about 16—1—16 with 5 perfect laterals. There are distinct side cusps as well as cutting points to the central and lateral teeth.

Z. viridulus (pl. XVII., fig. 6). Morse gives 54 rows of 27—1—27 teeth each. I have figured the central and first lateral, with one extreme marginal tooth, drawn from a specimen furnished me by Mr. Allen of Orono, Maine. I find three lateral teeth.

Morse gives a similar figure. The European *Z. viridulus* as figured by Lehmann (*Z. purus*) has a similar dentition; he gives 23—1—23 teeth, with 3 laterals.

There are decided side cups as well as cutting points to central and lateral teeth.

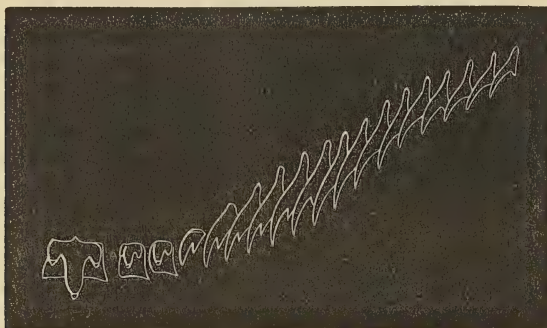
Z. indentatus (pl. XVII., fig. 3). The lingual examined has 38—1—38 teeth, with 3 perfect laterals. Morse counted 53 rows of 39—1—39 teeth, also three perfect laterals.

Z. limatulus (pl. III., fig. 3), has 23—1—23 with 5 laterals.

Z. minusculus (pl. XXI., fig. 9). Morse's figure shows four perfect laterals. He counted 52 rows of 12—1—12 teeth. It will be noticed that his figure does not show the cutting points of the side cups of the central and lateral teeth, which I have found in specimens lately examined from Florida. I found a similar number of teeth.

Z. milium is described by Morse (fig. 6), as having 68 rows, of 17—1—17 teeth, with only 2 perfect laterals. The next six teeth

Fig. 6.

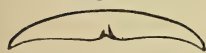


Z. milium.

are shown to be bifid, not only the one or two transition teeth, but the decided marginals. I have also drawn the membrane of this species (pl. XVII., fig. 8). I found 18—1—18 teeth, with 3 laterals.

The peculiarity of the lingual of this species is the great development of the central tooth. The jaw also is peculiar in having vertical channels worn upon its anterior surface, extending down to the cutting margin (see fig. 7, copied from Morse). These chan-

Fig. 7.

Jaw of *Z. milium*.
[Morse.]

nels are probably worn by the greatly developed central tooth of the lingual membrane. I do not agree with Morse in considering the great development of the central tooth, and the channels on the jaw as generic characters.

Z. Binneyanus is described by Morse with 60 rows of 23—1—23 teeth, with two perfect laterals which have a form of inner side cutting point.

On pl. XVII., fig. 13, I give a figure of the teeth on a membrane examined by me, kindly furnished by Mr. Anson Allen, of Orono, Maine. I find 19—1—19 teeth, with 3 laterals. I doubt there being any inner cutting points to the lateral teeth.

Z. ferreus (pl. XVII., fig. 9), is described by Morse with 39 rows of 20—1—20 teeth. I found 20—1—20 teeth also, with 2 laterals. The central tooth is greatly developed, and the jaw (fig. 8) has vertical median channels, or groves, as in *Z. milium* (see above, fig. 7).

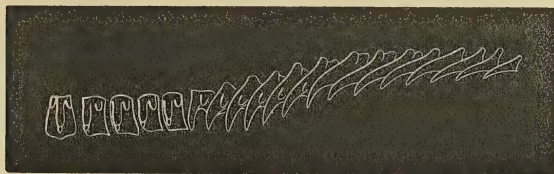
Fig. 8.

Jaw of *Z. ferreus*. [Morse.]

Z. conspectus, not examined.

Z. exiguus. I give here a copy of Morse's figure, having 69

Fig. 9.

*Z. exiguus*.

rows of 16—1—16 teeth, with 4 perfect laterals. The transition teeth and several of the adjoining marginals are described by Morse with a small side spur to their cusps, apparently of the same type as I have figured for *Macrocyclus Vancouverensis* (pl. I., fig. 4). On pl. XVII., p. 14, I give a drawing of a specimen examined by me. I found 16—1—16 teeth with 5 laterals.

Z. chersinellus, not examined.

Z. capsella (pl. III., fig. 4), 25—1—25 teeth, with 3 perfect laterals, and one transition tooth.

Z. fulvus. Morse gives 80 rows of 18—1—18 teeth, with 7 laterals. The specimen examined by me (from Orono, Maine) has 30—1—30 teeth with 8 perfect laterals. The difference in the marginals is unusual for two individuals of the same species.

The peculiarity of the lingual is the bifurcation of all the marginal teeth. On pl. XVII., fig. 5, I have drawn one central with its adjacent lateral, and one marginal extracted from a Maine specimen.

By the bifurcation of the marginals this species is allied to *Z. Gundlachi*, which, however, has even some of its marginals tricuspid, and tricuspid laterals.

The American form here under consideration was described by Mr. Say under the name *chersina*. Judging from its shell alone, it seems identical with the European *L. fulvus*. It has thus been considered one of the circumpolar species common to the three continents. My confidence of this identity is now shaken by a study of the description and figure by Lehmann (Lebenden Schnecken, etc., p. 79, pl. X., fig. 24), of the dentition of the European *Z. fulvus*. He gives 86—100 rows of 25—1—25 teeth, the first two laterals he makes tricuspid, while they are only bicuspid in our form. The marginals appear to be bifid. The question of identity must therefore be considered as still open.

Z. Fabricii, not examined.

Z. Gundlachi (pl. III., fig. 10, *b*, shows two marginals from two adjoining transverse rows), 23—1—23 teeth, with 4 perfect laterals. This lingual is peculiar in having its marginals bluntly bifid, as in *Nanina* and *Vitrina*. Some of the marginals are even trifid. The laterals are also tricuspid.

Z. Stearnsi, not examined.

Z. gularis (pl. III., fig. 1), has 30—1—30 teeth, with 10 perfect laterals.

Z. suppressus (pl. XVI., fig. 2, *b* are marginals from near the edge of the membrane). Teeth 30—1—30, with 8 perfect laterals.

Z. lasmodon (pl. III., fig. 7, *b* the smaller figure shows the 38th tooth). Teeth 41—1—41, with 9 perfect laterals.

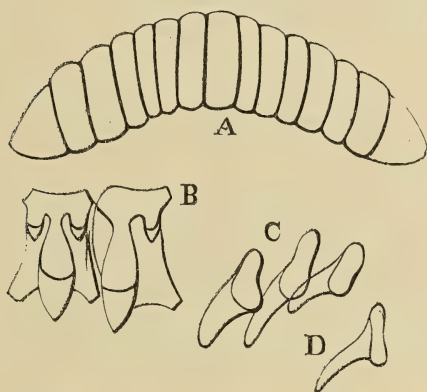
Z. significans (pl. XVII., fig. 10). 16—1—16, with 2 perfect laterals.

Z. internus (pl. III., fig. 9, *b* shows the 17th and 18th teeth, *c* the last tooth). Teeth 28—1—28, with 4 laterals.

Z. multidentatus (pl. XVII., fig. 1). The lingual examined had 14—1—14 teeth, with 2 perfect laterals. Morse gives 68 rows with 15—1—15 teeth, also 2 perfect laterals.

After my paper was prepared I have had an opportunity of examining the jaw and tongue of *Z. Lansingi*. It will be seen below that its ribbed jaw and aculeate marginal teeth do not sustain my assertion (p. 146) that for the larger divisions these organs may be relied on as systematic characters. The result of my examination of this species was as unexpected as it is puzzling.

Fig. 10.



Jaw (fig. 10, A) low, wide, slightly arcuate; ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with 14 broad, unequal, crowded, flat ribs, slightly denticulating either margin.

The first impression given by the jaw is that it bears narrow, separated ribs, as in *Bulimulus*, *Cylindrella*, etc. A more careful study of it, however, shows the ribs to be very broad, crowded, flat, with narrow interstices between them.

Lingual membrane with 17—1—17 teeth: 6 laterals. Centrals (fig. 10, B) with the base of attachment longer than wide, the lower lateral angles expanded; upper margin broadly reflected; reflection very short, tricuspid; side cusps decidedly developed, short, bearing distinct cutting points; median cusp long, slender, bulging at sides, reaching nearly to the lower edge of the base of

attachment, beyond which projects slightly the distinct, long cutting point. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower angle of the base of attachment, and inner side cusp and cutting point. Marginals (C) aculeate, their bases of attachment less sole-like than in *Zonites*, but more circular in outline.

Fig. 10, C, shows these bases of attachment. Fig. 10, D, gives one marginal tooth in profile.

This is the first known instance of a species with ribs on its jaw having aculeate marginal teeth, or of a species furnished with a *Zonites*-like shell having decided ribs upon the jaw. It will be difficult to find a place for the species under any description of genus or subfamily. The shell is that of *Zonites*, but that genus has a ribless jaw with median projection.

Fig. 11.

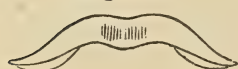


Fig. 12.



Fig. 13.

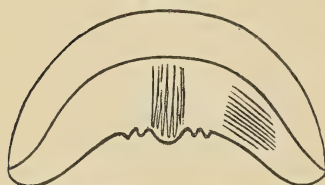


Jaw of *Z. arboreus*. [Morse.] Jaw of *Z. fuliginosus*. Jaw of *Z. indentatus*. [Morse]

The jaw of *Zonites* is arcuate, ends acuminate, often recurved; anterior surface without ribs; cutting margin with a beak-like projection.

I have examined the jaws of almost all the species enumerated above. There is considerable variation in their form, but the general characters are constant. Sometimes there is a vertical median carina, as in *Z. minusculus*. Some species have vertical striæ, especially on the middle of the jaw (see fig. 14). Some have strong transverse lines of reinforcement (see fig. 12). In several species, such as *Z. viridulus* and *Z. Binneyanus* (fig. 14), Morse has detected projecting points on the cutting edge of the side of the median beak. But I did not find them in a specimen of the last species examined by me; it is very high. That of *Z. exiguus* is very low. The median vertical grooves in some species have been mentioned above (fig. 7 and 8).

Fig. 14.



Jaw of *Z. Binneyanus*. [Morse.]

Formerly I separated the above species into two genera,

Zonites and *Hyalina*, respectively characterized by the presence or absence of a distinct locomotive disk to the foot, and well-marked furrows running above, and parallel to, the edge of the foot, meeting above the extremity of the tail over a distinct caudal mucous pore (fig. 15). I now place them all in *Zonites*, as all I have examined are so characterized, and I believe all will prove to be so. (See Ann. N. Y. Lyc. N. H., X. 164.)¹

The external orifice of the generative organs in the species I have examined is quite under the mantle, not on the right side of the head, as inadvertently stated on p. 29 of L. and Frw. Shells, I.

Genus **VITRINA**, Drap.

To the description of the animal on p. 29 of L. and Frw. Sh. N. A., I., must be added the fact of there being a distinct locomotive disk to the foot.

Fig. 16.



Lingual dentition of *V. limpida*. [Morse.]

The jaw is highly arched, ends acuminate, blunt; anterior surface smooth; cutting margin with a prominent beak-like median projection. I have figured the jaw of *V. limpida* on pl. XVI., fig. 3. I have found it to be the same in *V. exilis* and *Pfeifferi*. I have not examined either jaw or lingual membrane in *V. Angelicæ*. Fig. 16 gives a general idea of the lingual membrane. The centrals have a quadrangular base of attachment, longer than broad.

¹ I have also observed the caudal pore in *limatulus*. *Z. arboreus* has the longitudinal furrows, but on account of the transparent tissue of the foot I find it difficult to distinguish any caudal pore.

In *Z. ligerus* there are well-marked lines running obliquely towards the centre of the base of the foot, where is an extremely narrow line, representing, no doubt, the locomotive disk. The other characters of *Zonites* are present in the species.

The reflection is short, with three distinct cusps, the median long and slender, bulging at the sides, the outer ones very short; all the cusps bear cutting points in proportion to their length. The lateral teeth are arranged in straight transverse rows. They are like the centrals, but unsymmetrical by the partial suppression of the inner side cusp and inner lower lateral expansion of the base of attachment, and the complete suppression of the cutting point to the inner side cusp. The marginals have a sole-shaped base of attachment, and truly aculeate cutting points, which, however, are bluntly bifid at their points. The marginals are in oblique, curving rows, gradually decreasing in size of the teeth as they pass off laterally. They do not first increase and then decrease, as in *Zonites* and *Glandina*, or not, at all events, to the same degree. In *V. limpida*, as stated below, the seventh marginal appears, however, to be the largest.

In *V. limpida* I have counted 30—1—30 teeth, with 9 perfect laterals. The seventh marginal is the largest. Another gave 39—1—39, with 10 perfect laterals. The membrane figured by Morse had 25—1—25 teeth, with 9 laterals. I have figured of this species on pl. IV. one central and its adjacent lateral in fig. 8 *a*, and the twenty-third tooth, which is one of the marginals, in fig. 8 *b*.

Vitrina exilis has about 37—1—37 teeth, with 7 perfect laterals. I have given on pl. IV., fig. 7 *a*, one central and lateral; *b*, a group of marginals; *c*, an extreme marginal.

Vitrina Pfeifferi has over 50—1—50, with 10 perfect laterals. I figure a group of centrals and laterals, pl. IV., fig. 6 *a*, and one extreme marginal in *b*.

Genus **LIMAX**, Lin.

The character of the mantle and the peculiarities of the lingual dentition have suggested various subdivisions of this genus into sections, sub-genera, and even genera. I propose, however, to consider the genus in its widest sense, as generally adopted. It will be seen that even in the few species existing in North America, there is considerable variation in the lingual dentition, especially in the bifurcation or non-bifurcation of the marginal teeth, the development of the side cusps to the central and lateral teeth, and the presence or absence of distinct cutting points to these cusps. I shall, however, simply describe the dentition of our

species, leaving the question of subgeneric division to the future, and to abler hands.

As some confusion exists in regard to the specimens furnishing the descriptions and figures published in this country, I have taken pains to be sure of the specific identity of each specimen now before me.

The *L. maximus* was collected in Newport, R. I., by my friend, Mr. Sam. Powel. It is the same individual figured on p. 408 of my edition of Gould's Invertebrata of Massachusetts. The external markings of the animal are conclusive proofs of its identity with the European species. I have, however, made it still more certain by examining the genitalia, which I find agree with those of *L. maximus*, figured by Lehmann (Lebenden Schnecken, etc.). I find the dentition agrees also with the figures given by Heynemann (Malak. Blatt. X.), Lehmann (l. c.), and Goldfuss (Verh. Naturh. Vereins der Preuss. Rheinl., etc.).

The *L. flavus* was collected in a cellar in Burlington, N. J. It not only agrees with the figure in the "Terrestrial Mollusks" as far as its outward markings are concerned, but I find also its genitalia to agree with Dr. Leidy's figure in the same work, and also with the figure given by Moquin-Tandon (Moll. Fr.). Its dentition agrees with the figures of Heynemann and Semper (Arch. Phil.).

The *L. agrestis* was collected in a garden in Burlington, N. J. This species I have also found to agree with the figures of the external animal and genitalia given in the "Terrestrial Mollusks," as well as with Moquin-Tandon's (Moll. Terr. et Fluv. de la France) figure of the genitalia, and Heynemann's and Lehmann's figure of the dentition; also with the figure of the genitalia given by Schmidt and Lehmann.

The *Limax campestris* examined was collected in the country near Burlington, N. J., by my friend, A. Ten Eyck Lansing. It agrees with the description and figures in the "Terrestrial Mollusks," not only as to its external characters, but in its genitalia. I will here mention that its dentition does not agree with that of *L. Weinlandi*, Heynemann (l. c. p. 212), supposed by that author to be the same species.

The *Limax Hewstoni* examined is a typical specimen, given by Dr. J. G. Cooper to the State Collection of California. It was labelled by him. There can be no doubt, therefore, of its identity.

The *Limax Ingersolli* was received since this paper was commenced. It has not yet been described.

Being thus confident of the identity of the species before me, I will proceed to describe their jaws and dentition in detail.

I have examined the jaw of all the species, finding it to agree with the well-known character of the jaw in the genus. It is arcuate with slightly attenuated, but blunt ends; anterior surface smooth, cutting margin with a decided beak-like median projection. There is often a central vertical carina to the jaw. The ends are often more pointed than in the jaw figured.

Fig. 17.



Jaw of *Limax*.

Limax maximus, Linn. (pl. IV., fig. 4) has about 76—1—76 teeth. The centrals have a large, subquadrate base of attachment. The reflection is large, subquadrate, and bears a single stout median cusp, which has a short cutting point, often longer than in the teeth figured; the side cusps are subobsolete, and bear no cutting points. The lateral teeth, about 18 in number, are like the centrals, but unsymmetrical. The marginal teeth are aculeate. Only a few are simple, as in fig. b, the balance are bifid, as in fig. c. The bifurcation of the marginals commences much nearer the median line than in the specimens examined by Lehmann and Heynemann. There are, indeed, but twelve marginals without the bifurcation on one membrane examined.

Limax flavus,¹ Linn. (pl. IV., fig. 1). The specimen examined has about 60—1—60 teeth, with 16 laterals. The centrals and laterals are of the same type as in *L. maximus*, the outer marginals are also bifid. Pl. IV., fig. 1, represents the dentition of the species. On other portions of the same membrane the cutting points are longer and sharper. Fig. c represents an extreme marginal. Both of the figures of this species, published by me,² were drawn from lingual membranes of another species.

Limax agrestis,³ Linn. (pl. IV., fig. 3, a. b. c.) has about 50—1—

¹ L. and Frw. Sh. N. A., I. p. 63, fig. 105, is no doubt *L. agrestis*. Fig. 6, p. 285, of Ann. Lyc. N. H., N. Y., vol. IX., would more correctly represent the dentition of this species, if the extreme marginals were bifid.

² The description and figure given by Morse (Journ. Portland Soc. N. H. 1864, 7, fig. 1) of the jaw of this species could not have been drawn from any *Limax*, as it is said to be ribbed. The figure of the lingual membrane, also (pl. III., fig. 2), does not give the impression of aculeate marginals.

³ The figure given of the marginals of *L. agrestis*, by Lindström (Gotlands

50 teeth, with 18 perfect laterals. The centrals have a much more graceful outline to the reflection than in the two last-named species. The median cusp is longer and more slender, with a more slender cutting point; the subobsolete side cusps are more marked, and bear well developed, triangular, slightly curved cutting points. The lateral teeth are like the centrals, but unsymmetrical by the suppression of the inner lateral lower expansion of the base of attachment. There is, however, an inner cutting point lying against the inner side of the cusp, rather than in a position corresponding to the outer cutting point; it is very difficult of detection, being on a different plane from the outer cutting point, and readily confounded with the inner lower angle of the base of attachment. It is figured by Lehmann and Heynemann. The marginals are long and slender, without bifurcation even on those on the extreme edge of the membrane. Fig. 105 of p. 63 of L. and Frw. Shells N. A. I., probably was drawn from a specimen of this species, certainly not from one of *flavus*.

Goldfuss (l. c. pl. V., fig. 4) omits the cutting points from his figure.

Limax Hewstoni, J. G. Cooper (pl. IV., fig. 2). The centrals and laterals are of the same type as in the last species, with this important difference, that there is a well-developed cutting point of the usual form (not the peculiar form as in *L. agrestis*) to the inner subobsolete cusp of the laterals, and the inner lower lateral expansion of the base of attachment of the laterals is not suppressed as usual to make the laterals unsymmetrical. From this it follows that the central teeth are with difficulty distinguished from the laterals, until the outer ones are reached, when the inner cutting point and inner lower lateral expansion of the base of attachment are suppressed as in the other species of *Limax*. The marginal teeth are not bifid. Teeth 30—1—30, with 14 perfect laterals. Fig. *b* represents the very last marginals. As in the membranes of almost all species of land shells, there is considerable difference in the marginals on different portions of the same membrane. Those figured are the least slender.

This species, by the presence of the inner cutting point of the laterals and non-bifurcation of the marginals, resembles *Limax* (*Amalia*) *gagates*, as figured by Semper (Phil. Archip., pl. XI.), and

nutida Mollusker, pl. I., fig. 3), disagrees with my observation by the bifurcation of the marginals.

Amalia marginata, as figured by Heynemann (l. c. pl. III., fig. 7). Goldfuss also (l. c. 1856, pl. IV., fig. 3) figures the dentition of *L. marginatus* as the same.

Limax campestris, Binney (pl. IV., fig. 5, *a. b. c.*). One specimen has 40—1—40 teeth, 18 perfect laterals. Another gives 36—1—36, with 11 perfect laterals. The centrals and laterals are of the same type as described above in *L. agrestis*, excepting that there is no peculiar inner side cutting point to the first laterals. About half of the marginals are bifid. I find great difficulty, however, in detecting any bifurcation on the extreme marginals.

As stated above, Heynemann's figure of the dentition of *L. Weinlandi* could not have been drawn from this species. I have no information in regard to *L. Weinlandi* other than what I find in Malak. Blatt. X. 212, pl. III., fig. 1. Judging from the dentition alone I should hardly consider it distinct from *agrestis*.

L. campestris differs greatly in its genitalia from *L. agrestis*, to which it has been compared.

This completes the list of North American *Limaces* now known. I will add that *maximus* and *flavus* are put by Heynemann in the s. g. *Heynemannia*; *agrestis* in s. g. *Agriolimax*; *campestris* would be placed by him in s. g. *Malacolimax*; while *Hewstoni* would be placed by him in the genus *Amalia*.

Since the above was written I have received specimens collected in the mountains of Colorado by Mr. Ernest Ingersoll, of a species for which I propose the name *L. Ingersolli*. A full description will be published later. I will here simply state that there are 50—1—50 teeth, with 16 perfect laterals. All the marginals have a blunt spur to the cutting point, so that they may be said to be bluntly bifid.

The dentition of *Limax* is nearly allied to that of *Zonites*. The lateral teeth are arranged in straight transverse rows, the marginals in oblique rows, as aculeate marginal teeth always are. This tendency to obliquity in the rows of aculeate teeth we have seen most plainly shown in *Glandina*. To show the general arrangement of the teeth in straight and oblique rows I repeat the figure by Morse in L. and Frw. Sh. N. A. I., which was probably drawn from *L. agrestis*. It must be borne in mind that this figure is not intended to show the characters of the separate teeth, for which I refer to my plate.

The genus *Limax* differs from *Zonites* in its dentition by hav-

ing more slender, spine-like marginals, instead of the short, strictly aculeate form. The base of attachment of the marginals in *Limax* is also different, being less sole-like, and more irregularly circular on the extreme marginals. Another difference is

Fig. 18.

Lingual dentition of *Limax*.

that the marginal teeth do not increase in size so rapidly, and then decrease gradually as they pass off laterally, thus giving an irregularly crescentic form to each half of every transverse row. In *L. maximus* the marginal teeth decrease gradually in size from the first to the last. It is the same with *agrestis*, and I believe the character to be generic.

b. Jaw in one single piece, marginal teeth quadrate.—*HELICINÆ*.

In grouping the genera of *Helicinæ*, I have placed (1) those whose jaw has no distinct ribs upon its anterior surface; (2) those whose jaw has decided stout vertical anterior ribs; (3) those whose jaw has delicate, distant ribs generally running obliquely towards the median line of the jaw.

(1) Jaw without decided ribs on its anterior surface.

Genus *PATULA*, Held.

In none of the American species of this genus have I found a jaw with distinct well-formed ribs as in *Helix*. In several species,

Fig. 19.

Jaw of *Patula asteriscus*. [Morse.]

Fig. 20.

Jaw of *Patula striatella*. [Morse.]

Fig. 21.

Jaw of *P. alternata*.

however, such as *strigosa* and *Cooperi*, there are distinct traces of

subobsolete ribs near the cutting margin. In *asteriscus* there are coarse wrinkles, resembling subobsolete ribs. In *perspectiva*, *striatella*, and *Idahoensis* there are such wrinkles, and also coarse vertical striæ. I have not found the striæ as oblique as shown in fig. 20. In *solitaria*, *alternata*, and *Hemphilli* there are no traces of either ribs, wrinkles or striæ. In all these species there is a tendency to a median projection to the cutting edge. This is greatly developed in *solitaria*, *alternata*, and especially in *Hemphilli*. The last two species have also a much more arcuate jaw than the others. I have not seen the jaw of *Haydeni*, *Cumberlandiana*,¹ *tenuistriata*, *Horni*, *pauper*, *incrustedata*, or *vortex*.

Patula is described by von Martens as having a ribbed jaw, which does not agree with my observations on the jaw of our North American species. As there appears considerable confusion in regard to the limits of the genus, I think it best to make no reference here to any species foreign to America.

Fig. 22.

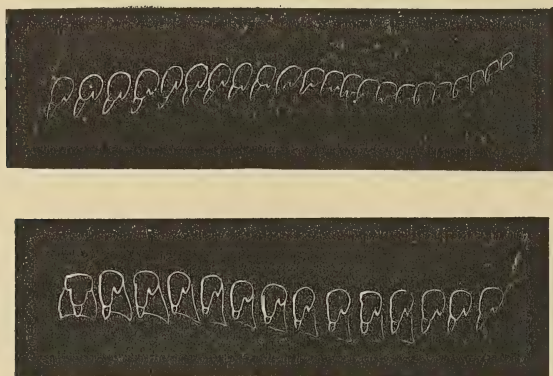
Lingual dentition of *P. alternata*. [Morse.]

Fig. 22 shows the general arrangement of the teeth on the membrane. The characters of the individual teeth are better shown on my plate VII.

There is considerable difference in the lingual dentition of the species I have grouped in this genus as to the development of the side cusps to the central and lateral teeth, and the presence of dis-

¹ I have lately received a specimen from University Place, Tenn., from Dr. Elliott. The jaw has very coarse perpendicular striæ.

inct cutting points upon these cusps. Such cusps and points are present in *solitaria* (pl. VII., fig. 9), *alternata* (fig. 5), *perspectiva* (fig. 3), *striatella* (fig. 10), *Hemphilli* (fig. 6), *Idahoensis* (fig. 4), *asteriscus* (pl. XVIII., fig. 9).

I do not detect these cusps in *P. strigosa* (pl. VII., fig. 1), *Cooperi* (fig. 2), probably the same species, or *Cumberlandiana*, excepting on the outer laterals (see pl. VII., fig. 1 *d*).

The central and lateral teeth of all the species examined by me are, in other respects, as usual in the *Helicinæ*. It will be noticed that the base of attachment is subquadrate, the reflected portion large (except in *asteriscus*), the cusps short, the cutting points short.

All the outlines of the teeth are less graceful than in *Zonites*. The lateral teeth are made unsymmetrical by the suppression of the inner lower angle of the base of attachment, and the less development, if not suppression, of the inner cusp, which loses the cutting point also. The marginal teeth are quite different from those of *Zonites*, *Limax*, *Vitrina*, *Macrocyclis*, and *Glandina* in not being aculeate. They are more crowded than in those genera. They have a quadrate base of attachment, not sole-like, shortened on its inner lower side, but produced at its outer lower margin. The reflected portion is as wide as the base of attachment, is more produced than in the central and lateral teeth, retains its width throughout, and bears two oblique, blunt cutting points, the inner one always much the larger and longer, and the outer one of which, in most of the species, has a tendency to bifurcation. There is considerable variation in these cutting points even in the same lingual membrane, but as a general thing it may be said that the marginal teeth are but a modification of the form of the laterals. They decrease in size greatly at the outer edge of the lingual membrane.

It must be borne in mind that the cutting points vary in development on different portions of any one lingual membrane. I have in each case chosen for drawing such individual teeth as appear best to illustrate the general character of the dentition.

In *P. strigosa* (pl. VII., fig. 1) there are 50—1—50 teeth, with 15 perfect laterals, *c* is an extreme marginal. I give in fig. *e* a central tooth drawn from the membrane of an embryonic young found in the oviduct.

P. solitaria (pl. VII., fig. 9) has 25—1—25 teeth, with 14 perfect laterals. The transition to marginals is very gradual.

P. Cooperi (pl. VII., fig. 2), 29—1—29, with 11 perfect laterals.

P. Hemphilli (pl. VII., fig. 6) has 20—1—20 teeth, with 7 perfect laterals.

P. Idahoensis (pl. VII., fig. 4) has 33—1—33 teeth, with 14 perfect laterals. The transition from the laterals to the marginals, however, is very gradual.

P. Haydeni not examined.

P. alternata (pl. VII., fig. 5). One membrane has 121 rows of 34—1—34 teeth, ten of which are perfect laterals. The variety *mordax*, pl. VII., fig. 7, agrees with it in dentition, except the number of teeth. I counted 20—1—20, with 5 perfect laterals.

P. Cumberlandiana (pl. VII., fig. 8) has 24—1—24 teeth, with about 13 perfect laterals. There is an appearance of a side cutting point to the third tooth, a decided one beyond the sixth.

P. tenuistriata, not examined.

P. perspectiva (pl. VII., fig. 3), 15—1—15 teeth, 7 perfect laterals.

P. striatella (pl. VII., fig. 10), 20—1—20 teeth, with 8 perfect laterals. Morse gives 16—1—16.

P. vortex (pl. XX., fig. 4), 18—1—18, with 8 laterals. A marginal tooth is shown in *b*.

P. Ingersolli, Bland. The species should, perhaps, be placed in *Microphysa*. Jaw of same type as in *H. Lansingi* (above), with 22 ribs. Teeth 16—1—16, with a gradual change from laterals to marginals. The latter are low, wide, with one inner, long, blunt cutting point, and one outer, small, blunt. The side cusps and cutting points of centrals and laterals are well developed.

P. pauper, *Horni*, *incrustedata*, not examined.

P. asteriscus (pl. XVIII., fig. 9). Morse gives 77 rows of 13—1—13 teeth; 6 perfect laterals. I counted 11—1—11, with 5 perfect laterals. The reflected portion of the central teeth is quite small. The marginal teeth are like those of *Pupa*.

It will be seen that *Patula* differs from all the preceding genera by the presence of quadrate, not aculeate, marginal teeth, a character shared by all the succeeding genera. There does not appear any very essential character in the dentition by which to distinguish it from many of American sub-genera of *Helix*, as will

be seen below. It will be noticed that one species, *asteriscus*, has marginal teeth like those of *Pupa* and *Vertigo*.

Genus **HEMITROCHUS**, Sw.

In Ann. Lyc. N. H. of N. Y., X., 341, I have, in connection with my friend Mr. Bland, shown the necessity of using this name in preference to *Polymita*.

The jaw is arched with acuminate ends, smooth anterior surface, and decided median prominence to cutting margin.

Fig. 23.



Jaw of *H. varians*.

Fig. 23 represents the jaw of *H. varians*. The lingual membrane (pl. XIII., fig. 1) has about 33—1—33 teeth, another specimen gave 43—1—43 teeth, with 17 perfect laterals. The central tooth has a long, narrow base of attachment with lower, outer angular expansions and incurved lower margin. The reflected

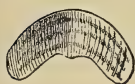
portion is only about one-half the length of the base of attachment, is short, and bears one short, stout cusp with an equally short, stout cutting point; the side cusps and cutting points are obsolete. The laterals are the same as the centrals, but unsymmetrical. The outer laterals have a side cusp and cutting point. The marginals are low, wide, and have one broad, long, oblique, bluntly bifid cutting point, the inner division the smaller, and a very much shorter side cutting point. This side cutting point is also sometimes bluntly bifid in the extreme marginal teeth.

The dentition of the other species of this genus, extralimital to North America, examined by me, agrees with that of this species. (See Pr. Phila. Ac. N. S., 1874, 56.)

Genus **TEBENNOPHORUS**, Binn.

One species only is known to exist in North America, *T. Caroliniensis*. It has an arched jaw (fig. 24), with blunt, scarcely attenuated ends, ribless anterior surface, and decided blunt median projection to the cutting edge. The

Fig. 24.



Jaw of
*Tebennophorus
caroliniensis*.

jaw is thick, coarse, with vertical and parallel transverse lines of reinforcement, but has no appearance of ribs. I have verified this fact by examining numerous specimens of all ages from various parts of the country. My observations have been confirmed by Morse, also (Journ. Portland Soc. N.

H. 1864, 7). I am therefore inclined to doubt the identity of the

specimen which Heynemann (Mal. Blatt. 1862, pl. III., fig. 12) describes with a ribbed jaw. Bergh (Zool. Bot. Gesell. in Wien, XX. 833) suggests that Heynemann may have had *Pallifera dorsalis* before him. Mörch, Journ. de Conch. 1865, suggests that it may have been *Veronicella Floridana*. At all events I do not believe it could have been the species now under consideration. I suspect it to have been *Pallifera Wetherbyi*. (See Ann. Lyc. Nat. Hist. of N. Y., XI. 31.)

The lingual membrane is arranged, as usual in the *Helicinæ*, as shown in fig. 25. It must be borne in mind that I offer this

Fig. 25.

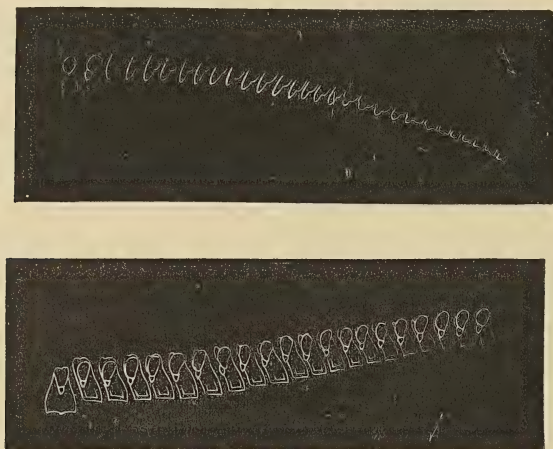
*T. Caroliniensis.* (Morse.)

figure simply to show the general arrangement of the teeth—the form of the individual teeth being much more accurately given in pl. VI., fig 1. Morse counted 115 rows of 56—1—56 teeth, another membrane gave 49—1—49 teeth, with 22 perfect laterals; I have myself counted 56—1—56 teeth, with 11 perfect laterals. The central teeth *a* have a very long narrow base of attachment widening towards the lower margin, which is excavated. There is a line of reinforcement running parallel to the lower edge, and for a short distance along the sides. The reflected portion equals only one-fourth of the length of the base of attachment. It is stout

and bears a short, stout, median cusp, having a short, blunt, cutting point. There are no side cusps or cutting points.

The laterals *b* are like the centrals, but unsymmetrical; their reflected portion is also longer. The outer laterals (*e*) have an outer side cusp.

The marginals *d* are a simple modification of the laterals, being quadrate, longer than wide, with one inner broad, long, oblique, bluntly pointed cutting point, bearing an inner, side, short, acute cutting point. These cutting points on the extreme marginals *e* are simply short and bluntly rounded.

Some membranes examined by me seemed to have an extension to the base of attachment beyond the upper margin of the reflected portion, to which it was parallel.

This membrane is peculiar in the long, narrow base of attachment and short reflected portion of the central and first lateral teeth.

Genus **HOLOSPIRA**, Mart. & Alb.

There are two species of this genus found within our limits, *H. Goldfussi* and *Roemeri*, the former of which I have been able to examine. I have not been able to examine lingual membrane of *H. Roemeri*, but, thanks to Mr. Bland, I have examined and here figure (pl. XX., fig. 10) that of *H. Goldfussi*. There are 26—1—26 teeth, with about 9 laterals. The cusps of the marginals are quite widely separated. The general characters of the teeth are as described below. I can refer also to Messrs. Fischer and Crosse for information regarding the jaw and dentition (Journ. de Conch. XVIII. 13, 1870, pl. V., and Moll. Mex. et Guat., 320, pl. XVI.) The jaw is arcuate, with slightly acuminate, blunt ends, thin, anterior surface ribless; cutting edge simple; transversely and vertically striated.

The lingual membrane in *H. Tryoni* and *Pfeifferi* examined and figured by those authors, is of the usual *Helicinæ* type. The centrals and laterals have a single short cusp, bearing a short, blunt cutting point, both side cusps and side cutting points being absent; marginal teeth quadrate, wide, low, with one long, inner, obtuse cutting point, and one outer, side, short, blunt cutting point.

Genus **HELICODISCUS**, Morse.

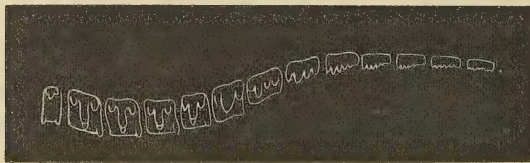
Jaw according to Morse, of the only known species, *H. lineatus*, low, wide, crescentic, ends much attenuated, acute; cutting margin with a median, beak-like projection; anterior surface without ribs, but covered with striæ converging obliquely towards the beak-like prominence.

Fig. 26.

Jaw of *H. lineatus*. [Morse.]

According to my rule of admitting in the genus *Helix* only such species as have a ribbed jaw, I am forced to recognize *lineatus* as a distinct genus. Fig. 27 shows the general arrangement of the

Fig. 27.

Lingual dentition of *H. lineatus*. [Morse.]

teeth upon the lingual membrane. The characters of the separate teeth are better shown in my plate XIII., fig. 5. Morse gives 77 rows of 12—1—12 teeth, each with 4 perfect laterals. Leidy, in Terr. Moll. U. S., II. 262, fig., gives 13—1—13 teeth, with 5 perfect laterals. The membrane examined by me has 12—1—12 teeth, with 4 perfect laterals. The central teeth have a base of attachment very small, longer than wide, with expanded lower angles, and reflected upper margin. Reflection very small, with a stout, short, median cusp, and very short, blunt side cusps, all the cusps with short cutting points. The lateral teeth have a base of attachment three times as wide, and somewhat longer than the centrals, and unsymmetrical by the suppression of the inner, lower lateral expansion; the upper margin is broadly reflected; the reflection is short but symmetrical, having two equally developed short, stout side cusps, bearing short cutting points; the median cusp is stout, long, extending nearly to the lower edge of the base of attachment, beyond which projects slightly the short cutting point.

The marginals are low and wide, the reflection as broad as the base of attachment, reaching nearly to its lower edge, and furnished

with one inner, long, bluntly bifid, stout, oblique cutting point, and two or more short outer cutting points. The same form of marginal is found in *Pupa*.

The membrane is very peculiar in the lateral teeth, not only from their large size, but also from their symmetrical, tricuspid reflection, quite like the usual arrangement of central teeth in the *Helicidæ*.

Genus **FERUSSACIA**, Risso.

The jaw (see pl. XVI., fig. 5 of that of the only species found in our limits, *F. subcylindrica*, Lin.) is low, slightly arcuate, wide, with but slightly attenuated, blunt ends; cutting edge with a slightly produced, wide, median projection; anterior surface without ribs, but with fine vertical striæ. There is a strong muscular attachment on its upper margin.

Figure 28 gives the general arrangement of the teeth, the cha-

Fig. 28.



F. subcylindrica.

acters of the separate teeth being better shown on pl. XV., fig. 9. This figure, as well as that of the jaw, I drew from a Maine specimen, furnished by Mr. Anson Allen. There were 24—1—24 teeth, with 8 perfect laterals. The central teeth are small and narrow in proportion to the laterals, with a long, narrow base of attachment, expanding at its lower angles. The reflected portion is very small, tricuspid; the central cusp stout, short; the side cusps small, blunt; all the cusps bear short cutting points.

The lateral teeth are about as wide as high in their base of attachment, which is subrectangular. The whole upper edge is squarely reflected. The reflection is very short, and bears a stout, blunt, long, inner cusp, reaching almost to the lower edge of the base of attachment, and bearing a long, blunt cutting point, which reaches beyond the lower edge. The outer side cusp of the reflection is widely separated from the inner cusp, is very short, bluntly rounded, and bears a short, blunt cutting point. The first mar-

ginals (fig. *b*) are but a modification of these laterals, by the greater development of the reflection, and shortening of the inner cusp. The outer marginals (fig. *c*) become wide, low, irregular in shape; the upper edge broadly reflected, the reflection reaching the lower edge of the base of attachment, and bearing along its whole length numerous (6 or 8 in some teeth) short subequal denticles, some bluntly rounded, others longer and sharp, giving a pectinate appearance.

My study of this membrane confirms my belief of the identity of the species with the European form. I have carefully compared the dentition of our form with that described and figured by Lehmann (Lebenden Schnecken, 132, pl. XIII., fig. 44), and find them to agree. I must, therefore, disagree with the decision of Morse (Journ. Portl. Soc.). I have also examined the genitalia of our species, and found it to agree with Lehmann's figure (l. c.), especially in the existence of the very peculiar flagellum to the penis sac. This, however, cannot be considered as a most reliable specific character peculiar to this species, as it exists also in *Cæcilianella acicula*.

I am very confident of the presence of well-developed side cusps to the central teeth, which Morse (l. c.) does not figure, though they are figured by Thomson, Ann. Mag. N. H., VII., pl. IV., fig. 8. They appear to me also to bear the short cutting points which I have figured.

Genus **CÆCILIANELLA**, Bourg.

I have not been able to examine the jaw or dentition of *C. acicula* (*Cionella acicula* of L. and Frw. Shells, I. 227), the only species found in our limits. They are both well known, however, from the descriptions and figures of Moquin-Tandon, Thomson, Sordelli,¹ and Lehmann. The jaw is low, wide, arcuate, with delicate vertical striæ. The lingual membrane (Lehmann, Lebenden Schnecken, p. 128, pl. XIII., fig. 43) has 120 rows of 11—1—11 teeth each. The centrals are small, tricuspid (Sordelli), the laterals, six in number, are larger, and have a more highly developed reflection, and are also distinctly tricuspid. Marginals subquadrate, with a broad reflection, bearing delicate denticles.

¹ Sordelli (Atti della Soc. Italiana di Sc. Nat. XIII., fasc. 1, p. 50; pl. i. f. 25) describes the ribs to be not straight, but curving, with a median point projecting toward the end of the jaw, so that each rib resembles quite exactly the sign called "brace" by printers.

Genus **STENOGYRA**, Shuttl.

I have not been able to examine *S. octonoides* (*S. subula* of L. and Frw. Shells, I.) or *S. gracillima*, but only *S. decollata*, Lin., from Charleston,¹ S. C., a species introduced from Europe by commerce, and the true *S. subula* found near Mobile, Ala. Of extralimital species I have examined *S. octona*, *gonostoma*, and *hasta*. Semper has examined *S. Panayensis*.

The jaw (see pl. XVI., fig. 1, for that of *S. subula*) is low, wide, with attenuated, blunt ends, and a wide, slightly produced median projection. There are distinct vertical striæ on that of *S. decollata*.

The lingual membrane is long and narrow. The central tooth has a very small, high, narrow base of attachment, the lower outer angles generally somewhat expanded. The reflected portion is very small, and bears a short, stout, median cusp, and two very small side cusps; all the cusps bear distinct cutting points. The lateral teeth are very much larger than the centrals. The base of attachment is about as high as wide, its inner lower lateral expansion suppressed as usual. The upper edge is squarely reflected. The reflection is very large, and bears one stout median cusp, extending almost to the lower edge of the base of attachment; there is also an outer, much smaller side cusp, and a less developed, sometimes subobsolete inner side cusp; all the cusps have distinct cutting points, proportioned to their size; that on the central cusp being greatly developed. In *S. decollata* (pl. XV., fig. 5) the inner cutting point is also much developed, and joined to the central cutting point. The marginal teeth in *S. decollata* are but a modification of the laterals, with the suppression of the inner cusp and cutting point (*b*); the extreme marginals (*c*) differ in the greater development of the reflected portion and equalization with it of the cutting points, of which there are but two. In *S. subula* (pl. XV., fig. 8) the marginal teeth (*b*) have more numerous cutting points, formed by the bifurcation of the inner and outer cutting point. The second denticle from the inner side is the largest. It will be noticed that in *S. decollata* both the side cutting points of the laterals are quite thorn-shaped.

S. decollata, L. (pl. XV., fig. 5, *b* is one of the first marginals,

¹ I found the species in great numbers at various localities in this city during a recent visit (1875).

c extreme marginal)—a Charleston specimen. There are 38—1—38 teeth, with 11 perfect laterals.

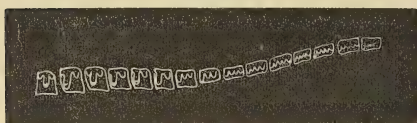
S. subula, Pfr. (pl. XV., fig. 8, *b* is an extreme marginal). There are 24—1—24 teeth, with 6 perfect laterals.

Genus **PUPA**, Drap.

I have personally examined the jaw and lingual membrane in only two species, *P. fallax* (pl. XV., fig. 12) and *P. rupicola* (pl. XV., fig. 2). For information about the other species I am indebted to Mr. Morse, whose figures are copied below.

The jaw is low (in *P. rupicola*, pl. XVI., fig. 7, strongly arched), wide, arcuate; ends but little attenuated in *muscorum*, *pentodon*, *fallax*, *rupicola*; acutely pointed in *corticaria*; a more or less developed, broad, blunt median projection to the cutting edge; anterior surface without ribs, but generally with vertical striæ.

Fig. 29.

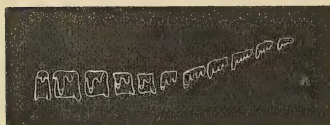


P. muscorum. [Morse.]

Figure 29 gives a general view of the arrangement of the teeth on the lingual membrane. Pl. XV., fig. 2, shows more correctly the characters of the individual teeth of the genus. The mem-

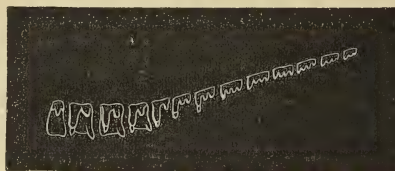
brane is long and narrow, the teeth are as in the genus *Vertigo* described below; excepting that in *Pupa* the central tooth is quite small in proportion to the laterals. The marginal teeth are irregularly denticulated, the inner denticle the largest.

Fig. 30.



Lingual dentition of *Pupa pentodon*.
[Morse.]

Fig. 31.



Lingual dentition of *Pupa corticaria*.
[Morse.]

P. muscorum (see fig. 29 above), has 90 rows of 14—1—14 teeth, with six perfect laterals. The figure and description of Lehmann of the European *P. muscorum*, confirm my belief in the identity of the two forms.

P. Blandi, *Hoppii*, *variolosa*, *decora*, *corpulenta*, *Rowelli*, *Californica*, *modica*, *Arizonensis*, *hordeacea*, *armifera*, *borealis*, *contracta*, and *pellucida*, not examined.

P. pentodon has 64 rows of 10—1—10 teeth, with 4 perfect laterals (fig. 30).

P. corticaria has 12—1—12 teeth, with 3 perfect laterals (fig. 31).

P. rupicola (pl. XV., fig. 2) has 11—1—11 teeth, with 5 perfect laterals.

P. fallax (pl. XV., fig. 12) has 15—1—15, with 7 perfect laterals.

Genus **VERTIGO**, Müll.

Jaw more or less arched, ends but little attenuated, blunt: anterior surface with delicate vertical striæ; cutting margin with a more or less developed median projection.

Fig. 32.

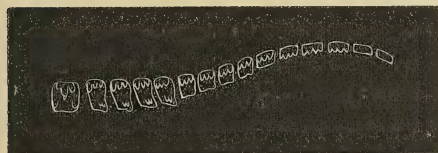


Jaw of *Vertigo ovata*. [Morse.]

I have given figure 32 copied from that of Morse. In the L. and Frw. Shells N. A., I., will be found other figures of jaws showing the variations in outline found in the genus. I have personally examined the jaw in none of our species.

For the characters of the lingual dentition I am also entirely dependent on Morse.

Fig. 33.



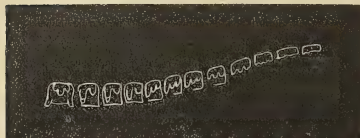
Lingual dentition of *Vertigo ovata*. [Morse.]

Figure 33 shows the general arrangement of the teeth on the membrane. The membrane is long and narrow. The central teeth have a base of attachment higher than wide, subrectangular. The whole upper

margin is broadly reflected. The reflection is very short, and bears three short stout cusps, the central the longest, each cusp bearing (I presume) a distinct cutting point. The central tooth, in those species whose dentition is known to me, is as large as the laterals, and not smaller, as seems to be the rule in our species of *Pupa*. The lateral teeth are like the centrals, but unsymmetrical. The reflected portion is small, tricuspid or bicuspid. The marginals are wide, low, with a broad, irregular, denticulated reflection. Mr. Morse gives the following count of the teeth. *V. Gouldi* (fig. 34) has 75 rows of 11—1—11 teeth, with 7 perfect laterals. *V. Bolle-*

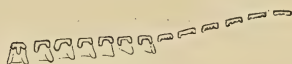
siana (fig. 35) has 88 rows of 12—1—12 teeth, with 6 perfect laterals. A comparison of this description and figure with that of Lehmann, pl. XIV., fig. 53, will prove that this species cannot be identical with *P. pygmaea* of Europe, as has been suggested by Mr. Gwyn Jeffreys (Ann. Mag. Nat. Hist., 1872, 246).

Fig. 34.



Lingual dentition of *Vertigo Gouldi*.
[Morse.]

Fig. 35.



Lingual membrane of *Vertigo Bollesiana*.
[Morse.]

V. milium, not observed.

V. ovata (see above figure 33) has 90 rows of 14—1—14 teeth apparently with 9 perfect laterals. The species has been referred to *P. antivergo*, but the figure of the dentition of that species given by Lehmann (pl. XIV., fig. 52) does not sustain the theory of identity.

V. ventricosa has 98 rows of 13—1—13 teeth, with 6 perfect laterals (fig. 36).

V. simplex, not observed.

Fig. 36.



Lingual membrane of *Vertigo ventricosa*. [Morse.]

Genus **STROPHIA**, Albers.

But one species, *S. incana*, Binn., is found within our limits. I have found it to agree in the characters of its jaw and lingual membrane with the extralimital species which I have examined, *S. iostoma*, *mumia*, and *decumana*. Semper, however (Phil. Arch. 128), describes the jaw of *S. uva* as being without median projection to its cutting edge; that character, therefore, cannot be considered generic.

Fig. 37.



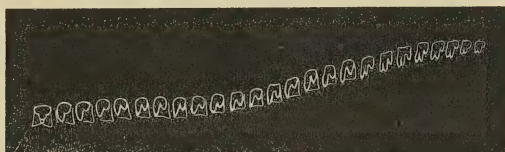
Jaw of
S. incana.

Jaw of *S. incana* (fig. 37) arcuate, thick, coarse, of about equal height to its bluntly truncated ends: cutting edge with a slightly produced median projection. Anterior surface without ribs.

Fig. 38 shows the general arrangement of the teeth upon the

lingual membrane. I regret not being able to give more accurately the characters of the individual teeth,¹ but have lost the membrane

Fig. 38.

Lingual dentition of *S. incana*.

in removing it for examination. There are 129 rows of 24—1—24 teeth each. See Proc. Ac. Nat. Sc. Phila., 1874, pl. VIII., fig. 1, for figure of dentition of *S. decumana*.

(2) Jaw with decided short, vertical ribs to its anterior surface.

Genus **ARION**, Fér.

I have not been able to give any information regarding two species found within our limits, *A. Andersoni* (see below, p. 194), and *A. foliolatus*. Indeed there seems so much uncertainty in regard to them, that I doubt their belonging to this genus. For fuller information, see Ann. N. Y. Lyc. of N. H., X. 297. This leaves only one species, *A. hortensis*, Fér., described and figured in Terr. Moll. U. S., and in L. and Frw. Sh. N. A., I., referred to *A. fuscus*, Müll.

The species was introduced by commerce into Boston many years ago. It still exists there,² specimens having been found by me in 1871, from one of which I extracted the jaw and lingual membrane here described. I have compared the figures of the genitalia of *A. hortensis* given by Lehmann and A. Schmidt³ with those given by Leidy in Terr. Moll. U. S. There is a difference in the position of the retractor muscle of the penis. Leidy places it at the base of the penis sac, Lehmann at the top, Schmidt omitting

¹ Too late for illustration in the text, I have received specimens collected by Mr. W. W. Colkett at Key West. There are 27—1—27 teeth, of the same type as in *P. decumana*, referred to in the text.

² Specimens can readily be found in gardens between Chestnut and Mt. Vernon Streets above Willow Street, as well as elsewhere.

³ Der Geschlechtsapparat der Stylommatophoren, 1855.

it entirely. The last two authors figure a retractor to the duct of the genital bladder, and so does Leidy (though in the description of the plates he refers it to the vagina). Lehmann figures a retractor also to the genital bladder itself. Lehmann's figure of the genitalia of *A. fuscus* (pl. VI., fig. 2) agrees more closely with Leidy's figure in all respects, indeed, but the position of the retractor penis, which Lehmann places at the top of the penis sac. His figure of the dentition of *fuscus* is nearer mine of the Boston specimens than is his of *hortensis*, though the transverse count of teeth is larger. Goldfuss' figure of the dentition of *A. hortensis* also (l. c. pl. V., fig. 6) differs from my figure in the same way, *i. e.*, by the presence of an inner side cusp and cutting point to the lateral teeth. Thus I find it impossible to decide from the genitalia whether to refer our species to *fuscus* or *hortensis*, though I incline to the former. From the dentition I should assuredly adopt the former name also.

The jaw of the Boston specimen (pl. XVI., fig. 2) is thick, arcuate, ends but little attenuated; no median projection to the cutting edge: anterior surface with 8 stout, separated, unequal ribs, denticulating either margin.

Lingual membrane (pl. V., fig. 5) long and narrow. Teeth about 31—1—31, with about ten perfect laterals. Centrals with the base of attachment longer than wide: reflection half as long as the base of attachment, bearing one long, stout cusp extending to the lower margin of the base of attachment, beyond which projects the stout cutting point: side cusps distinct, but small, with distinct, small, stout cutting points. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower, lateral expansion of the base of attachment, and the inner side cusp and cutting point. The marginals are low, wide, with one long, bluntly pointed, oblique cutting point, bearing a subobsolete smaller point low down upon its outer side. This subobsolete side cutting point is on some of the marginals much more developed.

My figure *a* shows one central with its adjacent lateral, and *b* and *c* marginals, the latter form near the outer margin of the membrane.

From the above remarks it will be seen that in this genus, as in *Limax*, *Zonites*, and others, the lateral teeth are either bicuspid or tricuspid. The number of cusps does not seem a generic character.

Genus **ARIOLIMAX**, Mörch.

Jaw thick, slightly arcuate, ends but little attenuated, blunt; low, wide: anterior surface with numerous stout ribs, denticulating either margin. The number of ribs varies in the several species, and in different individuals of the same species. Fig. 39, drawn from the true northern *A. Columbianus*, has 18 ribs; another specimen, supposed to be the same species, has about 12. (See Proc. Ac. Nat. Sc. Phila. 1874, pl. II., fig. 11.) *A.*

Fig. 39.

Jaw of *Ariolimax
Columbianus*.

Californicus has given 13 and 14 ribs. *A. niger* has been described by Dr. Cooper with 20, but I found only 8 in one specimen which I refer to that species.

Fig. 498 of p. 279, L. and Frw. Shells N. A., I, gives the general arrangement of the teeth upon the lingual membrane. It is drawn from the true northern *A. Columbianus*. On pl. V., fig. 6, I have given more detailed figures of the dentition of a specimen I refer to this species. It will be seen that the central teeth have a base of attachment longer than wide, with expanded lower angles, and incurved lower margin; the upper margin is reflected; the reflection is large, broad, and has a short, stout median cusp, bearing a long, stout cutting point; the side cusps of the reflection are subobsolete, but there are well-developed triangular cutting points. The laterals are like the centrals, but unsymmetrical by the suppression of the inner lower lateral expansion to the base of attachment, and the inner side cutting point, the inner side cusps being still subobsolete.

The change from lateral to marginal teeth is shown in *b* and *c*, the median cusps and cutting point being greatly developed, and sometimes (*c*) having a side cusp and cutting point; the base of attachment is still narrower than in the first laterals. The marginals are shown in *d* and *e*. They are about as high as wide, the reflection equals the base of attachment and bears an extremely long, blunt, stout, oblique cutting point, with a side spur upon the last, in the extreme marginals developed into a short, stout, side cutting point. The cutting point of the marginals by its great development forms the chief characteristic of the membrane; it is well shown in profile (fig. *f*.). There were 22 perfect laterals in this specimen. The figure referred to above shows only 12 laterals, with 113 rows of 56—1—56 teeth each.

Ariolimax Californicus (pl. V., fig. 1) has the same type of dentition, but the bases of attachment are more developed, and are produced beyond the reflection at their upper margin. There are 80—1—80 teeth, with 9 perfect laterals.

Ariolimax niger, also (pl. V., fig. 3), has the same type of dentition as *A. Columbianus*, the side cusps of the centrals are, however, more developed. On one specimen I found marginal teeth with one inner stout, short, rounded cutting point, and two shorter, rounded, side cutting points (see fig. 2), instead of the usual long cutting point. This is the only variation in the dentition of the genus which I have noticed.

Since the above was written, I have received specimens which agree with Cooper's description of *Arion Andersoni*, which appear to be a true *Ariolimax*. Full descriptions will be given at another time. The jaw has 13 ribs. The lingual membrane has 48—1—48 teeth of the type usual in the genus.

Ariolimax Hemphilli, a species from Niles Station, Alameda County, California, which I am about to describe under the name of its discoverer, has a jaw with 8—12 ribs. Lingual membrane with 31—1—31 teeth of the type common to the genus.

For full remarks on this genus, see Proc. Ac. Nat. Sc. Phila. 1874, p. 33.

The genus, as far as now known, is restricted to this country; there are, therefore, no descriptions or figures of the jaw and dentition of foreign species to compare with ours.

Genus **PROPHYSAON**, Bl. and Binn.

Jaw of the single species known, *P. Hemphilli*, thick, low, wide, slightly arcuate, with but little attenuated ends, cutting margin without median projection; anterior surface with fifteen stout, irregularly developed, separated ribs, denticulating either margin (pl. XVI., fig. 9).

Lingual membrane (pl. V., fig. 4) long and narrow. Teeth about 40—1—40, with 16 perfect laterals. Centrals with a base of attachment longer than wide, reflection extending less than one-half the length of the base, with a very stout, short median cusp, bearing a stout, short, blunt cutting point, and on either side a subobsolete cusp bearing a stout, bluntly rounded, short cutting point. Laterals like the centrals, but unsymmetrical, as usual, by the suppression of the inner side cutting point and inner lower,

lateral expansion of the base of attachment. Marginals (*b*) low, wide, with one inner, stout, oblique cutting point and two outer, smaller, blunt cutting points.

As in all lingual membranes, there is a difference in the development of the cusps and cutting points on various parts. The teeth figured are the least graceful in their outlines.

Genus **BINNEIA**, J. G. Coop.

Jaw (fig. 40) low, arcuate, with blunt, scarcely attenuated ends; no median projections to the cutting edge; anterior surface with numerous, broad, crowded ribs.

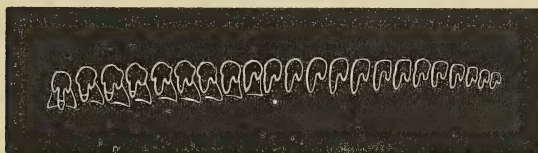
Fig. 40.



Jaw of *Binneia notabilis*.

Lingual membrane (fig. 41) as usual in the *Helicinxæ*. Centrals with a subquadrate base of attachment, with expanded lower angles; upper margin reflected; reflection large, bearing three distinct cusps, the central the longest; all three cusps apparently with distinct cutting points. Laterals like the centrals but unsymmetrical by the suppression of the inner cusp and cutting point, and

Fig. 41.



Lingual membrane of *Binneia notabilis*.

inner lower lateral expansion of the base of attachment. Marginals simply a modification of the centrals, subquadrate, higher than wide, with one inner, long, oblique, stout cutting point, and one outer, smaller, side cutting point.

I regret not being able to give a more satisfactory figure of the dentition of *B. notabilis*, our only known species.

It has 21—1—21 teeth, with 8 perfect laterals.

Genus **HEMPHILLIA**, Bl. and Binn.

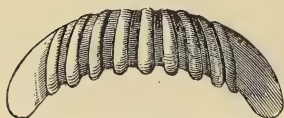
Jaw of the only known species, *H. glandulosa*, thick, low, wide, slightly arcuate, ends attenuated, blunt; cutting margin without median projection; anterior surface with about 14 crowded, stout, irregularly developed ribs, denticulating either margin (pl. XVI, fig. 6).

Lingual membrane (pl. V., fig. 7) long and narrow. Teeth 23—1—23, with 11 perfect laterals. Centrals with a quadrangular base of attachment, higher than wide. Reflection about half as long as this base, with a long, narrow median cusp reaching the lower margin of the base of attachment, beyond which projects slightly the short cutting point; side cusps but little developed, but bearing short, stout triangular cutting points. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the inner side cutting point. First marginal (*b*) with a square base of attachment, broadly reflected into one stout cusp, bearing a single, stout, very long, bluntly ending, oblique cutting point. Outer marginals (*c*) low, wide, the reflection broad, reaching the lower edge of the base of attachment, and bearing one inner, long, oblique, blunt cutting point; there appear no outer, small, side cutting points.

Genus **PALLIFERA**, Morse.

Jaw stout, arcuate, ends but little attenuated, blunt: anterior surface with stout separated ribs, 9 in *P. dorsalis* (fig. 42), over 15 in *P. Wetherbyi*. The jaw of the latter is arched, and has a blunt median projection, broken by the ends of the ribs. These last are more irregularly developed also.

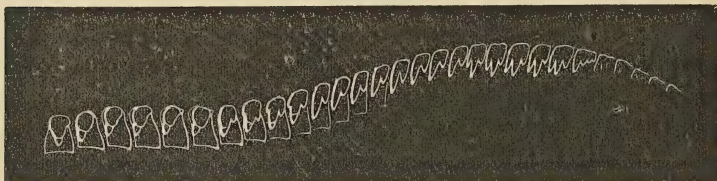
Fig. 42.



Jaw of *Tebennophorus dorsalis*!

Fig. 43 shows the arrangement of the teeth on the membrane in *P. dorsalis*, while separate teeth of the same species are more correctly drawn on pl. VI., fig. C.

Fig. 43.



Lingual dentition of *Pallifera dorsalis*.

Mr. Morse gives 115 rows of 56—1—56 teeth each, with 13 perfect laterals. In the specimen examined by me I found only 29—1—29 teeth, with 14 perfect laterals, a difference sufficiently

great to raise a doubt of the specific identity of the two specimens. The central teeth have a base of attachment longer than wide, with short lines of reinforcement running parallel to the outer edges at the lower margin. The upper margin is reflected. The reflection extends about one-third of the length of the base of attachment; it bears a central, stout, well-developed cusp, and one small, little-developed, rounded cusp at each side; all three cusps have stout cutting points. The lateral teeth are like the centrals, but unsymmetrical by the suppression of the inner cusp and cutting point, and inner, lower, lateral expansion of the base of attachment. The marginal teeth are low, wide; broadly reflected, the reflection equalling the length of the base of attachment, and very irregularly denticulated, there being usually one long, blunt, oblique, inner, bifid cutting point, the outer division much the shorter, and several short, blunt, outer cutting points.

P. Wetherbyi (pl. VI., fig. B), the only other species now known, has 35—1—35 teeth, with 13 perfect laterals. The teeth are different from those of *P. dorsalis*, and nearer those of *Tebennophorus Caroliniensis*. The side cusps of the centrals and laterals are subobsolete, and have no distinct cutting points, the median cusp is much more produced, stouter, and bears a stout, blunt, cutting point. The marginal teeth are not so wide, they are less irregularly denticulated, having usually one long, stout, blunt, oblique, inner cutting point, and one shorter side cutting point.

Genus **HELIX**, Lin.

In common with all who have studied the genus *Helix*, I am convinced of the necessity of recognizing among its species numerous distinct genera. I have, however, at this time eliminated those species only whose jaw has no distinct ribs upon its anterior surface.¹ The balance of the species I retain grouped as subgenera² only. Before recognizing these groups as distinct genera, I desire to wait until we can ascertain whether generic characters

¹ I fear that even this rule will not hold good. In some subgenera of *Helix* the absence or presence of ribs on the jaw is not a reliable character. For instance, in *Dentellaria* we have found the jaw of *H. Josephinae* and *formosa* without ribs. *H. dentiens*, *badia*, *pachygastra* are heavily ribbed. *H. lychnuchus*, *nucleola*, and *perplexa* less so.

² In the list of species given above (p. 152), I have used only the sub-generic names.

can be found in the jaws and lingual dentition as well as in the shells. I shall discuss the constancy of these characters under each group, as far as our material will allow. In this place I will merely mention that in general terms it may be said that *Pomatia*, *Tachea*, *Euparypha*, *Arionta*, and *Aglaja* have few, separated ribs, usually grouped near the centre of the jaw, leaving both extremities without ribs. *Mesodon*, *Triodopsis*, and *Polygyra* have numerous, separated ribs spread over the whole of the jaw. *Stenotrema* has numerous stout, crowded ribs also spread over the whole surface of the jaw. The ribs are also numerous, crowded, and similarly disposed in *Strobila*, *Gonostoma*, *Dorcasia*, and *Fruticicola*, but they do not so deeply denticulate both margins as in the genera mentioned above. All the above have a high jaw. The following have a much lower jaw: *Vallonia*, with numerous crowded ribs slightly denticulating the margins, especially the lower one; *Acanthinula*, with similar ribs, but quite arched; *Glyptostoma*, with still more numerous, separated ribs, deeply denticulating either margin; and *Polygyrella*, with more numerous ribs, and proportionally much wider to its height than in any of the other North American subgenera. Thus there seems to be some distinctive subgeneric character to the jaw. It must, however, be borne in mind that there are exceptions in some of the subgenera where the species are numerous; thus, in *Arionta*, I found numerous ribs in *ruficincta*, though the other species have but few. The number, disposition, and size of the ribs vary within certain limits in different individuals of the same species. I have repeatedly found this to be the case.

In regard to the subgeneric value of the type of lingual dentition, I can only say in general terms that within certain limits it may prove reliable. Here again, however, we find the type of dentition inconstant when many species are known. Thus in *Arionta* we find *Townsendiana* (pl. XVIII., fig. 8) quite differing from the other known species (see below). In *Mesodon*, also (pl. XII.), I find two quite distinct types of dentition, and under each subgenus I have pointed out the variation observed. I am convinced that the presence or absence of side cusps to central and lateral teeth is not a reliable subgeneric character. The marginal teeth offer more reliable characters. They are very peculiar in *Vallonia* and *Strobila*, in being very low and wide, and having numerous cutting points, quite resembling those of *Pupa*.

In *Mesodon*, *Triodopsis*, and *Arionta*, the marginals are longer than wide, with only two, sometimes bifid cutting points. In *Stenotrema* and *Polygyra* they are rather wider than long, also with two more bluntly bifid cutting points. It must be borne in mind, however, that my observations have not led me to believe these characters sufficiently constant to be of subgeneric value. I prefer to wait till more species have been examined. There is also some variation in the mode of passing from lateral to marginal teeth, even in the same subgenus. These points will be treated more fully under each subgenus.

Subgenus GONOSTOMA.

This subgenus is represented in our limits by one species only, *H. Yatesi*, J. G. Cooper, not Pfr., whose jaw and lingual membrane are here described. Jaw (pl. XVI., fig. 10) low, wide, slightly arcuate, ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with a strong transverse line of reinforcement, and numerous, about 12, wide, crowded ribs denticulating either margin.

Lingual membrane (pl. IX., fig. 3) long and narrow; teeth 24—1—24, with 6 perfect laterals. Centrals with the base of attachment longer than wide, with expanding lower lateral angles, and squarely reflected upper margin; reflection large, stout, bearing small but distinct side cusps, with short, blunt cutting points, and a long, stout, median cusp reaching the lower edge of the base of attachment, beyond which projects the long, acute cutting point. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the distinct inner side cusp and cutting point. Marginals subquadrate (*b*), a simple modification of the laterals, the reflection being more developed, and bearing one inner, oblique, long, blunt cutting point, and one smaller side cutting point; the extreme marginals (*c*) are rather wider than high, and the cutting points are bluntly rounded.

The name *Yatesi* being already preoccupied in the genus *Helix*, Dr. Cooper's species may be known as *Yatesiana*.

Von Martens describes the jaw of *Gonostoma* as having distinct ribs. Moquin-Tandon so figures that of *obvoluta*, Müll, *lenticula*, Fér, and *Rangiana*, Fér; and Gassies (Journ. de Conch., XV., 1867, 15) so describes that of *H. constricta*, B.

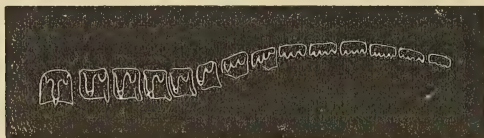
The lingual membrane of *obvolvata* is described by Goldfuss (l. c. 45) with a type of central teeth differing from that I have shown in *Yatesi*.

Subgenus STROBILA.

Jaw low, wide, slightly arcuate, ends scarcely attenuated, blunt; cutting margin without median projection; anterior surface with (over 12 in *labyrinthica*, numerous in *Hubbardi*) crowded ribs, denticulating either margin, and more developed on the centre of the jaw.

Lingual membrane of *labyrinthica* long and narrow, with 78 rows of 13—1—13 teeth each, with 5 perfect laterals. Morse

Fig. 44.



Lingual dentition of *Helix labyrinthica*. [Morse.]

figures 6 laterals. Centrals with a base of attachment about square, upper edge broadly reflected; reflection very short, bearing a long, slender, median cusp reaching the lower edge of the base of attachment, with a short cutting point extending slightly beyond it; side cusps very small, each bearing a short cutting point. Lateral teeth like the centrals, but unsymmetrical by the suppression of the inner lower angle of the base of attachment, and the inner side cusp and side cutting point. Outer laterals gradually changing into the marginals, which are low, wide, with a reflection equalling the base of attachment, and furnished with numerous (about 5) subequal, short cutting points, the inner one longest and bifid (pl. XVIII, fig. 7).

Morse mentions no ribs on the anterior surface of the jaw, but they are well developed on the specimen examined by me.

Helix Hubbardi, a specimen from Bonaventure Cemetery near Savannah, kindly opened by Mr. Bland, furnished a jaw and lingual membrane. Jaw long, low, slightly arcuate, ends acuminate; no median projection to cutting edge; anterior surface with numerous crowded ribs, denticulating either margin.

Lingual membrane with 14—1—14 teeth, 5 laterals. All the teeth like those of *H. labyrinthica* (pl. XVIII., fig. 11).

There are no known species foreign to North America, with which to compare the dentition and jaw of *labyrinthica* and *Hubbardi*.

Subgenus POLYGYRA.

Jaw high, arcuate, ends scarcely attenuated, blunt, cutting edge without median projection; anterior surface with numerous stout, separated ribs, denticulating either margin. I have counted 8 ribs in *H. ventrosula*; 14 in *pustula*; over 14 in *cereolus*; 10 in *espiloca*; 13 in *uvulifera*; 10 in *Texasiana*; 12 in *Troostiana*; 11 in *leporina*; 15 in *Mooreana*; 20 in *fastigans*; 7 in *septemvolva*; 10 in *Febigeri*; in *Hazardi*, *auriculata*, and *auriformis* they are also numerous. I have had no opportunity of examining the jaw in the other species found within our limits, *Postelliana*, *avara*, *Hindsi*, *triodontoides*, *tholus*, *hippocrepis*, *oppilata*, *Dorfeuilliana*, *Ariadnæ*, *cereolus* (see p. 203), *Carpenteriana* (see *ib.*), *pustuloides*.

By the character of its jaw, *Polygyra* can be compared only to *Triodopsis* and *Mesodon* among the other North American subgenera of *Helix*. No foreign species has yet been examined. The genus is almost exclusively North American, though several species have been described from the West Indies and Mexico, and one from Bolivia.

Fig. 46 shows the general arrangement of the teeth upon the

Fig. 46.



Lingual dentition of *Helix auriformis*? [Leidy.]

lingual membrane, the characters of the individual teeth being better shown in my plate VIII. The teeth do not differ from what I have described under *Stenotrema* (see p. 205). As in all the subgenera, there is considerable difference in the length of the base of attachment on the central and lateral teeth in the several species.

The marginals are lower and wider (see pl. VIII., fig. 1, *d*) than

in *Mesodon* and *Triodopsis*, but this character is not constant, the marginals of *auriculata* and *auriformis* being higher than wide. I find considerable difference also between the various species in the manner in which the lateral teeth pass into the marginals. In *auriformis*, *espiloca* and *Hazardi*, the change is made simply by the greater development of the inner cutting point, not by its bifurcation (see pl. VIII., fig. 5, *b*). In these species it is only the extreme outer marginals that have their inner cutting point bifid; in *H. auriformis* a very few extreme marginals have a bifid cutting point. This species and *H. auriculata* have very long inner cutting points to their marginal teeth (see fig. 9, *c* of pl. VIII.). In the other species examined by me the first marginals have their inner cutting point bifid, the transition from laterals to marginals being thus very distinctly marked. With these exceptions, the dentition of our species of *Polygyra* is very like that of *Stenotrema* (q. v.).

The dentition of no foreign species is known with which to compare our species.

The count of the teeth in the various species now follows:—

H. auriculata (pl. VIII., fig. 12) has 27—1—27 teeth with 12 laterals, 10 ribs on jaw.

H. uvulifera (pl. VIII., fig.) 23—1—23 with 8 laterals.

H. auriformis (pl. VIII., fig. 9) has 26—1—26 teeth, with 8 laterals. Fig. *c* shows the proportional greater development of the cutting point in the outer laterals.

H. Postelliana, Bland. Not examined.

H. espiloca, Rav. (pl. VIII., fig. 4) has 25—1—25 with 11 laterals.

H. avara. Not examined.

H. ventrosula (see L. and Frw. Shells N. A. I. p. 92, fig. 166), 93 rows of 24—1—24 with 9 laterals. I have not preserved this membrane, so cannot now correctly draw it.

H. Hindsi. Not examined.

H. Texasiana (pl. VIII., fig. 1) has 26—1—26 with 11 laterals.

H. triodontoides. Not examined.

H. Mooreana (pl. VIII., fig. 10) has 20—1—20 with 8 laterals.

H. tholus. Not examined.

H. hippocrepis. Not examined.

H. fastigans (pl. VIII., fig. 11) has 21—1—21 with 8 laterals.

H. Jacksoni. Not examined.

H. Troostiana (pl. VIII., fig. 2) has 25—1—25 teeth with 8

laterals. The marginals figured are from the portion of the membrane where they are the least developed as to their cutting points.

H. Hazardi (pl. VIII., fig. 5) has 16—1—16 teeth with 8 laterals.

H. oppilata. Not examined.

H. Dorfeuilliana. Not examined.

H. Ariadnæ. Not examined.

H. septemvolva (pl. VIII., fig. 6) has 9 laterals. I cannot count the teeth or draw the marginals on the only slide I have preserved. The latter were described by me as being like those of *fastigans*. After an opportunity of examining the true *septemvolva* at St. Augustine, I give a more detailed figure on pl. XX., fig. 5. There are 28—1—28 with 9 laterals. The small form with five whorls differs only in having somewhat fewer teeth. The form known as *H. volvoxis* does not differ excepting in having fewer marginals: Jacksonville, Fla., specimens have 20—1—20 teeth.

H. cereolus. Too late for illustration, I have received specimens collected at Key West by Mr. W. W. Calkins. There are 22—1—22 teeth, with 9 laterals all of same type as in *septemvolva*. 14 ribs on jaw.

H. Carpenteriana. 22—1—22 teeth, with 9 laterals, 12 ribs on jaw.

H. Febigeri (pl. VIII., fig. 7) has 17—1—17 teeth with 9 laterals.

H. pustula (pl. VIII., fig. 8) has 17—1—17 teeth with 8 laterals.

H. pustuloides. Not examined.

H. leporina. Too late for inserting in the plates, I have received through Mr. Bland, the jaw and lingual membrane of a Texas specimen furnished by Mr. A. G. Wetherby. The jaw has 11 ribs. There are 18—1—18 teeth, with 8 laterals, all of same type as in *H. fastigans*.

Subgenus POLYGYRELLA.

Jaw of the only known species, *Helix polygyrella* (pl. XVI., fig. 11) very low, wide, very slightly arcuate, ends very gradually attenuated: cutting margin without median projection: anterior surface with numerous (even 26), broad, slightly separated ribs, denticulating either margin.

Lingual membrane (pl. IX., fig. 2) long and narrow. Teeth 27—1—27, with 5 perfect laterals. Centrals subquadrate, the lower lateral angles but little expanded; the upper margin broadly

reflected: reflection large, wide, with distinct, but small, rounded side cusps bearing short conical cutting points, and a very stout median cusp reaching the lower margin of the base of attachment, beyond which projects the short, stout, conical cutting point. Laterals like the centrals, but unsymmetrical by the suppression of the inner, lower angle of the base of attachment, and the inner side cusp and cutting point. First marginals a simple modification of the laterals by the lesser development of the cutting point (*b*). Outer marginals (*c*) low, wide, the reflection equalling the base of attachment and bearing one inner, short, stout, oblique cutting point, and two shorter outer blunt cutting points.

Polygyrella is quite distinct from all the other American subgenera of *Helix* by the form of its jaw and the large number of ribs upon its anterior surface.

Subgenus STENOTREMA.

Jaw thick, high, arched; ends but little acuminate, blunt; cutting margin without median projection; anterior surface with stout, broad, crowded ribs, denticulating either margin. There are about 8 in *stenotrema*, 11 in *germana*,¹ 7 in *monodon*, 8 in *hirsuta*, 13 in *Edwardsi*, 12 in *barbigera*, 8 in *spinosa*.

Fig. 47.



Jaw of *Helix monodon*.
[Morse]

I have had no opportunity of examining *H. labrosa*, *Edgariana*, or *maxillata*.

The subgenus is restricted to North America as far as known. It differs from our other subgenera in having its ribs much broader and much more closely crowded.

Fig. 48.



Lingual dentition of *Helix monodon*. [Morse.]

Fig. 48, drawn by Mr. Morse, gives the general arrangement of the teeth on the lingual membrane. The characters of the individual teeth are more correctly shown in my figures on pl. IX.

¹ See Ann. Lyc. N. H. N. Y., X. pl. XIV., fig. 4. Perhaps a *Mesodon*.

Centrals with a base of attachment longer than wide, the lower lateral angles but little expanded, the lower margin incurved, the upper margin squarely reflected; reflection large, wide, with small, in some species almost obsolete, side cusps, always bearing distinct, well developed cutting points; and a very stout median cusp, bearing a stout cutting point which usually projects beyond the lower edge of the base of attachment. Laterals like the centrals, but unsymmetrical by the suppression of the inner lateral angle of the lower edge of the base of attachment and the inner side cusp and cutting point. The transition from laterals to marginals is shown in pl. IX., fig. 8 (*H. spinosa*). It is, as usual, produced by the comparative lesser development of the inner cusp and greater development of its cutting point. This cutting point becomes bifid, the reflection becomes shorter, the cutting points more produced, and thus gradually the form of the marginal teeth is reached. They are low, wide, the reflection equalling the base of attachment, the cutting points long, oblique, usually two in number, the inner one generally, and the outer one rarely, bluntly bifid: the outer bifurcation of each is more produced than the inner. There is great variation in the denticulation of the marginal teeth even on the same lingual membrane. A transition from laterals to marginals similar to that of *H. spinosa* is found in *H. barbiger*, *Edwardsi*, *stenotrema*, *hirsuta*, *germana*, and *monodon*.

There seems no difference in the characters of the teeth of the different species examined by me, excepting the slight one of the greater or lesser development of the side cusps of centrals and laterals, especially the former; whether this is constant can only be proved by a careful examination of every portion of each lingual. In *H. hirsuta* I found these cusps more developed than in the other species (pl. IX., fig. 6).

The count of the teeth in the different species is as follows:—

H. spinosa (pl. IX., fig. 8) has 27—1—27 teeth; 9 perfect laterals.

H. Edwardsi (pl. IX., fig. 1) has 20—1—20 teeth; 9 perfect laterals.

H. barbiger (pl. IX., fig. 9) has 21—1—21 teeth; 8 perfect laterals; but even the third has its inner cutting point greatly produced.

H. stenotrema (pl. IX., fig. 7) has 20—1—20 teeth; 10 perfect laterals.

H. hirsuta (pl. IX., fig. 6) has 22—1—22 teeth; 10 perfect laterals.

H. germana (pl. IX., fig. 5) has 28—1—28 teeth; 12 perfect laterals. Fig. 6 shows one of the few marginals which have the outer cusp bifid.

H. monodon (pl. IX., fig. 4) has 21—1—21 teeth; 10 perfect laterals. Morse gives 28—1—28 teeth.

H. labrosa, *maxillata*, and *Edgariana* not examined by me.

Subgenus TRIODOPSIS.

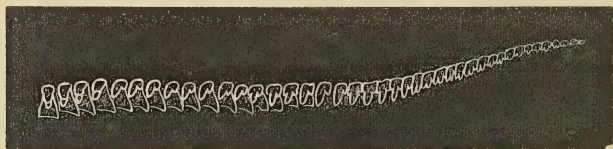
Jaw stout, arcuate, low, wide, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous decided, separated ribs, denticulating either margin. There are about 15 in *palliata*; 10 in *obstricta*; 15 in *appressa*; 14 in *inflecta*; 10 in *Rugeli*; 14 in *fallax*; over 10 in *Hopetönensis*; over 12 in *Harfordiana*; 11 in *loricata*; ¹ over 10 in *tridentata*. I have not examined *H. Mullani*² and *vultuosa*.

The subgenus is almost exclusively North American. Two Central American species have, however, been described, and one European species, *H. personata*, Lam. This last is said by Moquin-Tandon to have 3—5 separated ribs upon its jaw, while our American species, as shown above, have numerous ribs.

Triodopsis does not differ from *Mesodon* or *Polygyra* in the character of its jaw. *Stenotrema*, on the other hand, is readily distinguished by having the ribs broader and more crowded on its jaw.



Fig. 50.



Lingual dentition of *Helix appressa*.

The general arrangement of the teeth on the lingual membrane is shown in fig. 50. The characters of the individual teeth are given on pl. X. I have selected *H. appressa* (fig. 7) to show these

¹ The ribs are more crowded in this species.

² Probably identical with *devia*.

characters, comparing the dentition of the other species with it. The centrals are longer than wide; the base of attachment has its outer, lower, lateral expansion but little developed, its lower margin incurved, its upper margin squarely reflected; the reflection is stout, with subobsolete side cusps, but well-developed side cutting points, and a stout, short median cusp, bearing a cutting point which does not reach the lower margin of the base of attachment. The laterals are like the centrals, but, as usual in the genus *Helix*, unsymmetrical by the suppression of the inner, lower, lateral expansion of the base of attachment and the inner side cusp with its cutting point. The transition teeth are characterized by the gradual lesser proportional development of the reflection, and greater development of the inner cutting point; as the teeth pass outward, this point becomes bifid, the reflection becomes gradually shorter, until the true marginals are reached. These last are low, wide, the reflection equalling the base of attachment, the inner cutting point being greatly developed, long, oblique, bluntly bifid, the inner bifurcation the shorter of the two; the outer cusp is very short, blunt, sometimes also bifid. In fig. 7, the 10th is the first lateral showing decided modification; the 14th tooth has its inner point bifid; the 17th tooth is a decided marginal. The transition from laterals to marginals is so gradual that it is often difficult to give the number of perfect laterals. In many cases, therefore, the number given by me must be considered as only approximately correct. There is great variation in the denticulation of the marginal teeth.

The general character of the dentition of the other species is about the same as in *appressa*. I found great difficulty in detecting the side cutting points in several species, especially *tridentata* and *palliata*. In some species I did not find the transition teeth or inner marginals with bifid cutting point (pl. X., fig. 3, 4).

I give below the count of the teeth in the several species.

H. palliata (pl. X., fig. 2) has 34—1—34 teeth; 12 perfect laterals; another specimen had 14 laterals. Morse counted 115 rows of teeth. The inner cutting point of the transition teeth in this species is very large, as shown in *c*.

H. obstricta (pl. XVIII., fig. 10) has 33—1—33 teeth; 10 perfect laterals: very like *H. palliata*. My figures are drawn from that part of the lingual membrane which has the cutting points of its teeth

quite blunt. Other portions of the membrane would furnish much more sharply pointed teeth.

H. appressa (pl. X., fig. 7) has 33—1—33 teeth; about 12 perfect laterals.

H. inflecta (pl. X., fig. 4) has 22—1—22 teeth; 7 perfect laterals. This and the following species have inner marginal teeth with simple, not bifid, cutting points (*c*).

H. Rugeli (pl. X., fig. 3) has 21—1—21 teeth; 6 perfect laterals.

H. tridentata (pl. X., fig. 1) has 25—1—25 teeth; 10 perfect laterals. The inner cutting point is bifid after the 10th.

H. Mullani. The species is probably identical with *devia*.

H. Harfordiana has 26—1—26, with 12 laterals. Jaw with over 12 ribs. Received too late for illustration.

H. fallax (pl. X., fig. 5) has about 40—1—40 teeth; 14 laterals. This (not *tridentata*) had no bifurcation to the inner cutting point of the transition teeth, at least on the portion of the membrane examined by me.

H. introferens not examined by me.

H. Hopetonensis (pl. X., fig. 6) has 27—1—27 teeth as far as I can judge from an imperfect membrane. There are 7 perfect laterals.

H. vultuosa not examined.

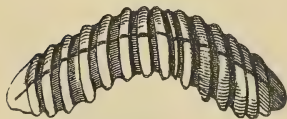
H. loricata (pl. XVIII., fig. 4) has over 20—1—20 teeth; 8 perfect laterals.

Helix personata is the only European species of this subgenus, but no figure of its dentition has been published to compare with that of our species. The same is true of the two Central American species known.

Subgenus MESODON.

Jaw stout, high, arcuate, wide, ends but little attenuated, blunt; no median projection to the cutting margin; anterior surface with

Fig. 51.



Jaw of *Helix Sayii*. [Morse.]

numerous, separated, decided ribs, denticulating either margin. I have counted 13 in *H. major*; 10 in *albolaris*; 10 in *multilineata*; 11 in *Pennsylvanica*; 12 in *Mitchelliana*; 12 in *elevata*; 13 in *Clarki*; 13 in *exoleta*; 18 in *Wetherbyi*; 14 in *dentifera*;

7 in *Roëmeri*: 13 in *thyroides*: 10 in *clausa*: 8 in *Columbiana*.¹
 7 in *devia*: 10 in *profunda*: 15 in *Sayii*: 10 in *Mobiliana*: over
 10 in *Downieana*.

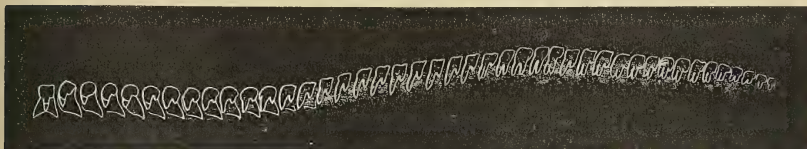
I have had no opportunity of examining *H. divesta*, *Christyi*,
Wheatleyi, and *jejuna*.

Nothing has been published regarding the jaw and lingual den-
 tition of the subgenus from species foreign to North America, as
 it is exclusively confined to this country.

The jaw of *Mesodon* does not essentially differ from that of
Triodopsis and *Polygyra*, but may readily be distinguished from
 that of the other American subgenera.

The lingual membrane is long and narrow. The general ar-
 rangement of the teeth is shown in fig. 52. The characters of the

Fig. 52.



Lingual dentition of *Helix multilineata*.

individual teeth are better shown in my plates. It will be seen
 that there are two distinct types of dentition among the species of
 the subgenus. The first form of dentition is found in *albolabris*
 (pl. XI., fig. 1), *Roëmeri* (pl. XI., fig. 3), *Wetherbyi* (pl. XI., fig. 2),
Downieana (pl. XI., fig. 4), *Sayii* (pl. XI., fig. 5) *exoleta* (pl. XI.,
 fig. 7), *Pennsylvanica* (pl. XVIII., fig. 3), *Mitchelliana* (pl. XVIII.,
 fig. 5), *elevata* (pl. XII., fig. 1), *Columbiana* (pl. XII., fig. 2),
Mobiliana (pl. XII., fig. 3), *devia* (pl. XII., fig. 4), *profunda* (pl.
 XII., fig. 5) *multilineata* (pl. XII., fig. 6), *dentifera* (pl. XII., fig.
 8), *Clarki* (pl. XI., fig. 6). Even among these species there are
 some important variations. Thus I have failed to detect any side
 cutting points on the subobsolete side cusps of the central and
 first lateral teeth of *Roëmeri*, *Wetherbyi*, *Downieana*, *Sayii*, *ex-*
oleta, *Pennsylvanica*, and *Mitchelliana*. All these species have
 their side cusp less developed than in the other species mentioned
 above. The presence of the cutting point may be detected by
 better manipulation than I am able to give, but as far as my powers

¹ See Ann. N. Y. Lyc. of N. H., X. pl. XIV., fig. 2.

go, I cannot find it. The outer laterals, however, in most of the species have a much more developed side cusp than the inner laterals, bearing a well-developed cutting point (see pl. XI., fig. 6, *d*), but not all the species, as *H. exoleta* for instance, as shown in pl. XI., fig. 7, *d*, has no well developed side cusp and cutting point on its outer laterals, nor does it appear except on the decided marginals. It is the same in *H. Sayii*.

I find also variation in the manner of passing from the lateral to the marginal teeth among the species of this first group of *Mesodon*. In *H. exoleta* (pl. XI., fig. 7, 14) the cutting point remains the same, and also in *Sayii*, *profunda*, *Wetherbyi*, and *Mitchelliana*, but in *elevata* (pl. XII., fig. 1, 18) the transition teeth are characterized by the bifurcation of the large cutting point; the same occurs in *albolabris*, *multilineata*, *Roëmeri*, *Columbiana* (pl. XII., fig. 2) and *devia*, and the rest of the group.

The general character of the teeth in this section of *Mesodon* is about the same as I have described above for *Triodopsis* (p. 260). It will be noticed, however, that the marginals (as in *H. exoleta* and *Wetherbyi*) do not always have their cutting points bifid.

The other type of dentition in the subgenus *Mesodon* is shared by *H. thyroides* (pl. XVIII., fig. 2), *clausa* (pl. XII., fig. 7), and *Wheatleyi* (pl. XVIII., fig. 1). The centrals and first laterals have subobsolete side cusps without cutting points, the outer laterals have no side cusp, but retain the type of the first laterals, they are much longer, narrower, and have one extremely long, oblique, stout, bluntly pointed cutting point, reaching far beyond the lower margin of the base of attachment. These outer laterals pass gradually into the marginals, which retain their general form but have a less developed reflection, and much more proportionally developed cutting point, sometimes bifid in the extreme marginals (pl. XVIII., fig. 2, 54), and usually with a small side cutting point.

As in all the subgenera of *Helix*, the marginal teeth of *Mesodon* show great variation in their denticulation, even in most cases on the same membrane. *H. Clarki* (pl. XI., fig. 6) has the marginals with cutting points much blunter and broader in some parts than in the others.

The study of the dentition of *Mesodon* shows that we must be prepared to find considerable variation in the character of the teeth of any subgenus. The peculiar outer lateral teeth and mar-

ginals of *H. thyroides*, for instance, would hardly have been expected, so utterly different are they from those of *albolabris*. Again, we should hardly have expected to find such a difference in the same subgenus, as the presence and absence of side cutting points on the central and first lateral teeth.

I will now give the count of teeth in the several species.

Helix major, not examined.

Helix albolabris (pl. XI., fig. 1). Outer laterals have distinct side cusps as well as cutting points. Teeth 44—1—44, with about 12 laterals. The inner cutting points of fig. *b* should be bifid.

Helix divesta, not examined.

Helix multilineata (pl. XII., fig. 6), 42—1—42; 12 laterals.

Helix Pennsylvanica (pl. XVIII., fig. 3), 40—1—40; 13 perfect laterals. Morse counted 120 rows of 39—1—39 teeth.

Helix Mitchelliana (pl. XVIII., fig. 5), 49—1—49; 18 laterals. Outer laterals have side cusps and cutting points.

Helix elevata (pl. XII., fig. 1), about 45—1—45; 17 laterals.

Helix Clarki (pl. XI., fig. 6), 35—1—35, with 15 laterals.

Helix Christyi, not examined.

Helix exoleta (pl. XI., fig. 7) has 56—1—56; 11 perfect laterals, but even the 8th tooth shows a decided modification in form.

Helix Wetherbyi (pl. XI., fig. 2) has 35—1—35; 12 laterals.

Helix Wheatleyi (pl. XVIII., fig. 1) has 67—1—67, with over 12 laterals.

Helix dentifera (pl. XII., fig. 8) has 32—1—32 teeth, with 15 laterals.

Helix Roëmeri (pl. XI., fig. 3) has 35—1—35 teeth, with 12 laterals.

Helix thyroides (pl. XVIII., fig. 2) has 60—1—60, with 11 laterals.

Helix clausa (pl. XII., fig. 7) has 41—1—41, with about 11 perfect laterals.

Helix Columbiana (pl. XII., fig. 2) has 33—1—33 teeth; 15 perfect laterals.

Helix Downieana (pl. XI., fig. 4) has 35—1—35 teeth, with 12 laterals. The side cusps and cutting points are visible on the second lateral tooth.

Helix Lawi, not observed.

Helix Mobiliana. The true species, from Baldwin County,

Alabama, Dr. E. R. Showalter (pl. XII., fig. 3). There are 25—1—25 teeth, with 10 perfect laterals.

Helix jejuna, not examined.

Helix devia (pl. XII., fig. 4) has 23—1—23, with 16 perfect laterals.

Helix profunda (pl. XII., fig. 5) has 40—1—40 teeth, with about 14 perfect laterals.

Helix Sayii (pl. XI., fig. 5) has 42—1—42 teeth, with about 15 perfect laterals.

Subgenus ACANTHINULA.

We have but one species within our limits, *H. harpa*, whose jaw and lingual dentition have been described and figured by

Fig. 53.

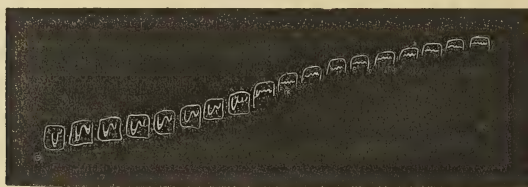


Jaw of
Helix harpa.
[Morse.]

Morse. Judging from his figure (fig. 53) and text, the anterior surface of the jaw seems to have sub-obsolete ribs which mark the lower margin; it is low, wide, strongly arched, with blunt, scarcely attenuated ends; cutting edge with a wide and very slightly produced, broad median projection; transversely and longitudinally striate.

Lingual membrane long and narrow, 120 rows of 17—1—17 teeth, with 6 perfect laterals. The centrals have a square base of

Fig. 54.



Lingual dentition of *Helix harpa*. [Morse.]

attachment, the upper margin squarely reflected; the reflection is very small, tricuspid, the side cusps very small, blunt, the median cusps very long and narrow, not reaching the lower edge of the base of attachment, not even with its short cutting point; side cusps also, I presume, with cutting points, though none are shown in Morse's figure. Laterals like the centrals, but unsymmetrical by the suppression of the inner side cusps, and cutting points.

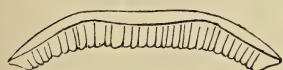
Marginals low, wide, the broad reflection equalling the base of attachment and irregularly denticulated, as in *Pupa*.

There are two European species of this subgenus, *H. aculeata* and *lamellata*, whose jaw is described by Lehmann as rather striated than ribbed. Their lingual dentition presents no sub-generic differences from that of *harpa*, though the cusps of the centrals are described as simply conical.

Subgenus VALLONIA.

Jaw low, wide, slightly arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous crowded, broad ribs, denticulating the lower margin.

Fig. 55.

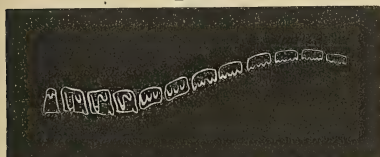


Jaw of *Helix pulchella*. [Morse.]

(Fig. 55.)

Lingual membrane (pl. XVIII., fig. 6) long and narrow. Morse gives 73 rows of 11—1—11 teeth, with 3 perfect laterals. I counted 10—1—10, with 3 perfect laterals. Centrals with the base of attachment long and narrow, expanded and

Fig. 56.



Lingual dentition of *Helix pulchella*. [Morse.]

notched at the outer lower angles, narrowed above and reflected; reflection very small, tricuspid, all the cusps bearing very short cutting points, the central one, as usual, longest. Laterals with the base of attachment twice as broad as in the centrals, the inner lower angle suppressed, notched at the outer angle, broadly reflected above; reflection larger than in the centrals, with one inner, long, slender cusp, reaching nearly the lower edge of the base of attachment, its cutting point quite reaching it, and one small outer side cusp, also bearing a distinct cutting point. Marginals low, wide, the reflection equalling the base of attachment and irregularly denticulated along its edge, the inner cusp the longest and bifid. The dentition is quite that of *Pupa*.

The above description is drawn from a specimen from Maine. The European form is figured by Moquin-Tandon with a median projection to the cutting edge of its jaw. Lehmann also figures

a wide, slight projection to the cutting edge. A comparison of the description and figure of the dentition of the European specimens given by Thomson and Lehmann shows no specific difference. It will be noticed that Lehmann's figure of the centrals shows a more developed reflection and cusp and no side cusps. I believe, however, that careful comparison will show no variation in this or other particulars.

Subgenus FRUTICICOLA.

The two species of this subgenus found within our limits, *H. rufescens* and *H. hispida*, are purely local, having been introduced by commerce at Quebec and Halifax, respectively. I have not had an opportunity of examining either. The jaw of the subgenus is described as arcuate with blunt ends; anterior surface with broad, crowded ribs (see figure of that of *hispida* copied from Moquin-Tandon); Lehmann (l. c., pl. XII., fig. 57) figures the lingual membrane of *hispida* with centrals having a long narrow base of attachment, a stout, pear-shaped, unicuspid reflection; laterals bicuspid, marginals a simple modification of the laterals. Other species are also figured by Lehmann.

Fig. 57.



Jaw of
Helix hispida.

Subgenus DORCASIA.

I hesitate to place our two species, *H. Berlandieriana* and *griseola* in this subgenus on account of the geographical range of its species. I will, however, temporarily leave them here. I do not believe they properly belong to *Fruticicola*.

I have not examined *H. Berlandieriana*. The other species, *griseola*, has a jaw (pl. XVI., fig. 14) slightly arcuate; high, ends scarcely *attenuated*, blunt; cutting margin without median projection; anterior surface entirely covered with numerous, about 12, broad, crowded ribs, denticulating either margin.

Lingual membrane (pl. XIII., fig. 2.) long and narrow. Teeth about 27—1—27, with 12 perfect laterals. Centrals with the base of attachment long and rather narrow, the outer lower angles but little expanded, the upper margin broadly reflected; reflection large, with a very stout, long median cusp, bearing a long, stout cutting point extending below the lower edge of the base of attachment, side cusps obsolete, but side cutting points present, large, triangular, acute. Laterals like the centrals, but unsymmetrical by

the suppression of the inner, lower lateral angle of the base of attachment and inner side cutting point. Marginals (*b*) low, wide, the reflection broad, equalling the base of attachment and bearing one inner, broad, long, oblique, bifid cutting point, the inner division the smaller, and two outer, smaller, stout, sharp, side cutting points.

Subgenus *AGLAJA*.

Jaw thick, high, arched, ends but little attenuated, blunt; cutting edge without median projection; anterior surface with stout, separated ribs, denticulating either margin, from 5 to 9 in *H. infumata* (fig. 58), about 6 in *fidelis*. The other American species, *H. Hillebrandi*, I have not examined.

Fig. 58.



Jaw of
Helix infumata.

Lingual membrane long and narrow. That of *Hillebrandi* not examined, those of *infumata* and *fidelis* agreeing in their general characters. The centrals have a base of attachment longer than wide, with incurved lower margin and expanded lower lateral angles; upper margin broadly reflected; reflection short, stout, with no side cusps or cutting points, but a very stout, short median cusp, bearing a short cutting point. Laterals like the centrals, but unsymmetrical by the base of attachment wanting the inner, lower lateral expansion; it is, however, unusually developed on its inner side margin: first marginals (*b* of each figure) differing from the laterals by the equalling of the reflection and base of attachment, the lesser development of the cusp, and greater development of the cutting point, which is bluntly bifid, the inner division the smaller. On some of the first marginals of *infumata* (pl. XIII., fig. 9, *b*) there is a small side cutting point. Marginals low, wide, the reflection equalling the base of attachment, and bearing one long, oblique, wide, bifid cutting point, the inner division the smaller, and one or two short, sharp, side cutting points. There is great variation in the cutting points.

A comparison of the two figures will show a longer base of attachment in *fidelis*, with a line of reënforcement or duplication to its upper margin. As with all species, there is much variation in the length of the cutting point, in centrals and laterals, and their arrangement and development in the marginals.

H. fidelis (pl. XIII., fig. 8) has 48—1—48 teeth, with 15 perfect laterals. The first marginal is shown in *b*, an outer marginal in *c*. Usually the first marginals have a side cutting point.

H. infumata (pl. XIII., fig. 9) has 45—1—45 teeth, with 16 laterals. Fig. *b* is the 17th tooth, from a different portion of the membrane from *c*, which is the 20th; they show variation in the transition teeth as to the presence of the side cutting point. Extreme marginals are shown in *d*.

Of the dentition of the other species of *Aglaja* foreign to our limits but little is known. *H. Ghiesbreghti* (see Moll. Mex. et Guat.) has very dissimilar teeth, especially the marginals. *H. semiclausa* (Malak. Blak. XV., pl. IV., fig. 4) also differs in its dentition. The jaws of these species agree with those of *infumata* and *fidelis*.

Subgenus ARIONTA.

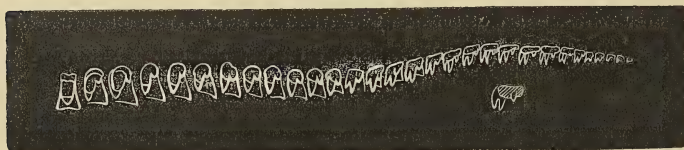
Jaw thick, high, arched, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with a few, separated, stout ribs, deeply denticulating either margin, and so disposed as to leave each end of the jaw free from ribs. I have counted 6 ribs on the jaw of *arrosa*; 9 in *Townsendiana*; 6 in *tudiculata*; 6 in *Nickliniana*; 6 in *redimita*; 6 in *exarata*; 5 in *Dia-bloensis*; about 7 in *Carpenteri*; 3 in *ramentosa*; 5 in *Californiensis*; 4—6 in *sequoicola*; 8 in *Traski*; 8 in *facta*; 6 in *Kelletti*; 9 of unequal size in *Stearnsiana*. The jaw of *ruficincta* differs in having over 10 ribs covering its whole surface, and in being only slightly arcuate.

Fig. 59.



Jaw of *Helix arrosa*.

Fig. 60.



Lingual dentition of *Helix facta*.

I have not examined the following species: *intercisa*, *Mormonum*, *Dupetithouarsi*, *Gabbi*.

The subgenus is almost exclusively confined to our limits. There

is, however, one *Mexican* species, one African, and one European, *H. arbustorum*. The jaw of the last agrees with our species.

The lingual membrane is long and narrow. Fig. 60 shows the general arrangement of the teeth upon the lingual membrane. The characters of the individual teeth are shown in my plates. I have selected *H. Stearnsiana* pl. XIII., fig. 3, to give an idea of the teeth in successive transverse rows. Fig. *a* shows a group of central and lateral teeth in two adjacent rows, *b* the transition from laterals to marginals, *c* marginal teeth from near the outer edge of the membrane. The central teeth have a base of attachment much longer than wide, with incurved lower margin and expanded lower lateral angles; the upper margin broadly reflected; reflection short, stout, with subobsolete side cusps bearing no cutting points, and a stout, long median cusp bearing a short, blunt cutting point, which does not reach the lower margin of the base of attachment; the reflection with the median cusp is pear-shaped; in many species there is a duplicate line of reënforcement parallel to the upper margin of the base of attachment. The lateral teeth are of similar type to the centrals, but are unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment. The outer laterals have a side cusp and cutting point. The transition from laterals to marginals is formed by the greater proportional development of the cutting point, the lesser development of the cusp; the cutting point then becomes bifid, the reflection becomes more nearly the same size as the base of attachment, and thus the true marginals are gradually reached. These last are longer than wide, have a base of attachment smaller than the reflection and cut away on its lower inner angle; the reflection is produced into one long, sharp, oblique, bifid cutting point, the inner division the smaller, and one outer, much shorter, sharp, rarely bifid cutting point.

Most of the species examined agree in dentition with *Stearnsiana*. Some have more blunt cutting points to their marginals, as *H. sequoicola* (pl. XIV., fig. 5), but even on various parts of the same membrane the marginals vary in this respect. In *Kelletti*, *Stearnsiana*, *tudiculata*, *arrosa*, *Traski*, *sequoicola*, *Ayresiana*, *redimita*, *Nickliniana*, *ramentosa*, *exarata*, I have failed to detect any side cutting points to the central and inner lateral teeth. I found the points, however, in *H. ruficincta* (pl. XIV., fig. 3). *H. Townsendiana* (pl. XVIII., fig. 8) has these cutting points and side

cusps on central and all the lateral teeth ; its centrals and laterals are not of the same shape as described above for *H. Kelletti*, but resemble those of *Polygyra*, *Stenotrema*, and *Triodopsis*. Thus in this as in other subgenera, we find the type of dentition not constant in all the species.

The long, narrow base of attachment and pyriform reflection of most of the species of *Arionta* agree with those of *Hemitrochus* (see p. 181) more nearly than any other of our genera or subgenera, but that genus has quite different marginal teeth.

The dentition of *H. arbustorum* is alone known of the species foreign to America, and that by a figure of Lehmann (Lebenden Schnecken, pl. XI., fig. 29) too unsatisfactory to be of value for the purpose of comparison.

H. arrosa (pl. XIV., fig. 2), 54—1—54 teeth. 17 laterals.

H. Townsendiana (pl. XVIII., fig. 8) has 60—1—60. Another membrane had 40—1—40.

H. tudiculata (pl. XIV., fig. 1), 50—1—50, with 26 perfect laterals.

H. Nickliniana (pl. XIV., fig. 8).

H. Ayresiana (pl. XIV., fig. 6), 50—1—50, with 15 perfect laterals.

H. redimita (pl. XIV., fig. 7). The 17th tooth has its inner cutting point split. 43—1—43.

H. intercisa, not examined.

H. exarata (pl. XIV., fig. 10), 54—1—54, 19 perfect laterals.

H. ramentosa (pl. XIV., fig. 9), 60—1—60, with 21 perfect laterals. The 18th tooth has the side cutting point.

H. Californiensis (see L. and Frw. Sh., 1., p. 171, fig. 297). Teeth 56—1—56.

H. Carpenteri. Too late for illustration, I have received specimens collected by Mr. Henry Hemphill. There are 48—1—48 teeth, with 20 laterals ; the side cutting points are visible beyond the 7th tooth.

H. Mormonum, not examined.

H. sequoicola (pl. XIV., fig. 5), 46—1—46, 18 perfect laterals.

H. Diabloensis.

Too late for illustration, I have received from Mr. L. G. Yates specimens of the form called *Diabloensis* by Dr. Cooper. There are 37—1—37 teeth, with 17 laterals. There are side cutting points beyond the 12th tooth.

H. Traski (pl. XIV., fig. 4), 36—1—36 ; the 13th tooth has the side cutting point ; 16 laterals.

H. Dupetithouarsi, not examined.

H. ruficincta (pl. XIV., fig. 3), 35—1—35, with 18 laterals.

H. Gabbi, not examined.

H. facta (see p. 216, fig. 60), 29—1—29, with 11 laterals.

H. Kelletti (pl. XIII., fig. 4), 57—1—57.

H. Stearnsiana (pl. XIII., fig. 3), 50—1—50, with 24 laterals.
The 22d tooth has the side cutting point.

Subgenus GLYPTOSTOMA.¹

One species only is thus far known, *Helix Newberryana*. Its jaw (pl. XVI., fig. 4) is low, wide, slightly arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous (about 16), stout, separated ribs, deeply denticulating either margin.

Lingual membrane (pl. XIII., fig. 6) long and narrow. Teeth 47—1—47, with 17 perfect laterals. Centrals with the base of attachment long and narrow, with greatly expanded lower, lateral angles, the upper margin rounded, broadly reflected; reflection large, stout, with obsolete side cusps, but with decided, triangular side cutting points; median cusp very stout, short, with a long, acute cutting point reaching beyond the lower edge of the base of attachment. Laterals like the centrals, but unsymmetrical by the suppression of inner, lower, lateral angle of the base of attachment and inner side cutting point. The transition from laterals to marginals is marked by the lesser proportional development of the cusp and greater development of the cutting point. Marginals (*c*) low, wide, the reflection equalling the base of attachment and bearing one inner, short, stout, oblique, blunt cutting point, and one outer, shorter, blunt cutting point.

This species, like all others, has great variation in the development of the cutting points on different parts of the same membrane.

Subgenus EUPARYPHA.

Jaw high, arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with a few (about 5 in *Tryoni*) stout, separated, unequal ribs, deeply denticulating either margin.

¹ See Proc. Phila. Ac. Nat. Sci., 1873, p. 244.

Fig. 61.

Jaw of *H. Tryoni*.

As usual in most of the species of *Helix*, etc., examined by me, the number, size, and disposition of the ribs vary in different individuals of the only species of *Euparypha* I have examined, *H. Tryoni*. In L. and Frw. Shells N. A., I., 179, six jaws are figured, all differing as to the ribs.

I have had no opportunity of examining *H. areolata*, the only other species found within our limits. Among the species of the subgenus foreign to the United States, *H. pisana*, Müll., alone has been examined, the jaw being figured by Moquin-Tandon with 2-3 ribs only, and the number of the teeth being given by Thomson.

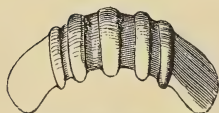
The only information I can give of the lingual dentition is shown in the figure of that of *H. Tryoni* (L. and Frw. Shells, I., 354). There are 190 rows of about 43-1-43 teeth each. There appear to be 16 perfect laterals.

The base of attachment is long and narrow; the reflection is pear-shaped, apparently without side cusps or cutting points in the central and first nine laterals. The balance of the laterals have the side cusp, and, no doubt, cutting point. I cannot from the figure describe accurately the characteristics of the marginal teeth. Unfortunately, I have preserved no membrane to describe and figure more accurately.

Subgenus TACHEA.

Our single species, *H. hortensis*, found only along the north-eastern coast, and there usually restricted to the islands, agrees in its jaw with the other known species of the subgenus. It is stout, arched, with blunt unattenuated ends; anterior surface with stout, few, separated ribs, denticulating either margin.

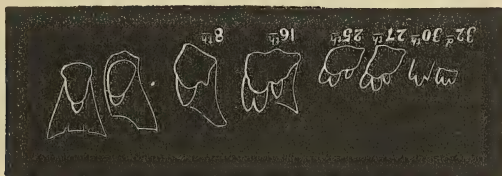
Fig. 62.

Jaw of *Helix hortensis*.
[Morse.]

The lingual membrane has 116 rows of 32-1-32 teeth each. The centrals have a subtriangular base of attachment, so greatly are the lower lateral angles expanded; upper margin reflected; reflection pear-shaped, without outer cusps, but a single stout middle cusp, half as long as the base of attachment, and bearing a short, conical cutting point, reaching only about one-half the distance to the lower edge of the base of attachment. First laterals like the centrals, but unsymmetrical by the irregular cutting away of the lower inner

angle of the base of attachment; outer laterals with a more developed cutting point and a decided side cusp and cutting point; the change from the laterals to the marginals is shown in the 16th tooth (see fig. 63), where the base of attachment is wider, the reflection stouter and the inner cutting point becomes bifid. The marginals are low, wide, the reflection equalling the base of attachment, the inner cutting point short, bluntly bifid, the outer shorter and blunt.

Fig. 63.

Lingual dentition of *Helix hortensis*. [Morse.]

Having no specimen to examine myself, I am dependent on Morse's figures given above.

Subgenus POMATIA.

Jaw of our only species, *H. aspersa*, introduced by commerce at Charleston, S. C. (where it is still common), high, thick, arcuate, ends but little attenuated, blunt; cutting margin without median projection; anterior surface with 6 stout, separated ribs, deeply denticulating either margin (pl. XVI., fig. 8).

Lingual membrane of the same species (pl. XIII., fig. 7, *a, b, c*) long and narrow. Teeth 50—1—50, with 15 perfect laterals. Centrals with base of attachment longer than wide, the lower lateral angles but slightly produced, the lower margin in some cases with a quadrate excavation or thinning as usually found in *Succinea*; the upper margin broadly reflected, reflection very large, with a very stout, short median cusp, bearing a short, stout cutting point reaching the lower edge of the base of attachment; side cusps obsolete, but bearing well developed, short side cutting points. Laterals like centrals, but unsymmetrical by the suppression of the inner, lower, lateral angle of the base of attachment, and the inner side cutting point. Transition teeth from the laterals to the marginals (*b*) with a more developed reflection, a shorter inner cusp bearing a greatly developed bifid cutting point. Marginals (*c*) low, wide, the reflection equalling the base

of attachment and bearing one inner, long, oblique, acutely bifid cutting point, and one shorter, outer, sometimes bifid, side cutting point.

The only other *Pomatia* whose dentition has been figured is *H. pomatia*, which shows the same type of teeth (Goldfuss, l. c. pl. IV., fig. 6). The jaw of numerous European species is known, and of the same type as in *aspersa*.

(3) Jaw with delicate, distant ribs to its anterior surface, usually running obliquely to the median line.

Genus **CYLINDRELLA**, Pfr.

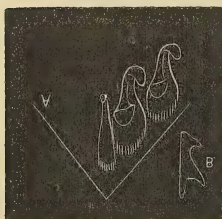
Jaw as in *Macroceramus*, described below.

Lingual membrane of our two species *C. jejuna* and *C. Poeyana* not examined by me. The dentition of the genus is very peculiar. The membrane is exceedingly long and narrow. The base of attachment of the centrals is small, long, narrow, with the upper margin broadly reflected into a blunt, rounded and expanded gouge-shaped cutting point; the laterals have a long, subquad-rangular base of attachment, bearing below, a large, bluntly rounded, greatly expanded, palmate cusp, representing the inner and central cusps of the laterals; and, above, a long, slender, graceful extension, representing the external cusp of the other *Helicidæ*. This last is bluntly truncated, or bears a recurved cusp smaller but of same shape as that below; or it has a laterally extended, small

blunt point. In some species the laterals extend to the margin of the lingual membrane;¹ in others there are distinct marginal teeth, long, narrow, laminar, with bluntly recurved apices. A full description and figures of these various forms of teeth will be found in *Journal de Conchyliologie*, January, 1870.

I here give a figure of the dentition of one only of these types represented by the membrane of *C. scæva*.

Fig. 64.



Lingual dentition of
Cyliindrella scæva. [Bland.]

¹ Probably this is the case in our species, as it is so in the allied *C. elegans*. See pl. XX., fig. 6.

Since the above was written, I find my anticipations realized in the case of *C. Poeyana*. Specimens from Key West collected by Mr. W. W. Calkins, have 14—1—14 teeth of same type as in *elegans*. There are over 40 ribs on the jaw.

Genus **MACROCERAMUS**, Guild.

Jaw thin, almost membranous, semi-transparent, light horn colored, strongly arched, ends acuminate; cutting margin without median projection; anterior surface with numerous delicate, separated ribs, denticulating both margins; these ribs run obliquely towards the median line of the jaw, so that the central ribs meet before reaching the lower margin of the jaw, forming an upper median triangular space between the ribs.

Fig. 65.

Jaw of *Macroceramus signatus*.

[Bland.]

It was formerly considered that this jaw was actually in separate pieces, whose overlapping margin formed the ribs upon the anterior surface (see fig. 65). More careful examination, however, has proved the jaw to be in one single piece, with delicate ribs upon its surface.

There are over 50 ribs on the jaw of the only one of our species I have examined, *M. Gossei*. I give a copy of Mr. Bland's figure of the jaw of *M. signatus*, which is similar.

The lingual membrane of *Macroceramus* was supposed to be the same as in *Cylindrella* described above, as that of *M. signatus* was so found by Mr. Bland (Ann. Lyc. Nat. Hist. N. Y., VIII., 162), and Crosse and Fischer (Journ. de Conch., 1870, pl. III., fig. 14-16). It was, therefore, with surprise that I found an entirely different type of dentition in *M. Gossei*. I can in this place only note the difference, and leave to future study the question of its bearing on the generic position of the species.

M. Gossei (pl. XV., fig. 1) has a membrane very long and narrow; teeth about 40—1—40, in scarcely oblique transverse rows, decidedly not *en chevron*. Centrals with a long, narrow base of attachment with somewhat expanded lower lateral angles, its upper margin squarely reflected. The reflected portion is very small, and bears three short, blunt cusps, the median the largest, all three with distinct cutting points. The base of attachment of the laterals is long and narrow, its outer lower angle irregularly cut away; the upper margin broadly and obliquely reflected, the reflected portion thrown off obliquely towards the margin of the lingual membrane, very short and bearing two stout, blunt, short cusps, the inner the larger, also thrown obliquely towards the

outer margin of the membrane; both of the cusps bear distinct cutting points, the outer one small, the inner one narrow, blunt, almost as long as the base of attachment. There are no distinct marginals, the laterals decreasing in size as they pass off laterally, those at the edge of the membrane (fig. *c*) having one large inner cutting point, and several, outer, irregular smaller ones. I have given *a* a group of centrals and laterals, *b* a group of laterals, and *c* an extreme lateral or marginal.¹

I have had no opportunity of examining *M. Kieneri*.

Genus **BULIMULUS**, Leach.²

Jaw thin, arcuate, ends but little attenuated; no median projection to the cutting edge; anterior surface with numerous, separated, delicate ribs, denticulating either margin, sometimes the upper median ones running obliquely towards the median line, or even arranged *en chevron* as in *Macroceramus*, with an upper median triangular compartment.

Fig. 66.



Jaw of
Bulimulus
dealbatus.

The jaw of *B. dealbatus* is here figured. It is quite arched. That of *B. Marielinus* and *alternatus* is of the same type. I have given on plate XVI., fig. 12, a more enlarged view of one end of the jaw of *B. sufflatus*, to show more accurately the character of the ribs.

The lingual membrane of the genus as now received varies too much to allow of a general description. It can only be said that the marginal teeth are quadrate, not aculeate. I will here simply confine myself to describing the membrane of the only one of our species of which I have preserved the lingual membrane.

Fig. 67 shows the general arrangement of the teeth on the membrane of *B. dealbatus*, the characters of the individual teeth being shown in pl. XV., fig. 7. There are 94 rows of 25—1—25 in one specimen examined. Another had 20—1—20 teeth, with 14 perfect laterals.

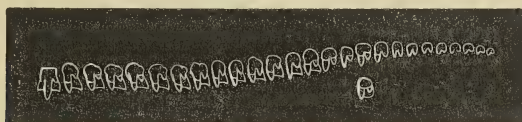
The central tooth has a base of attachment longer than wide, with but little expanded lower lateral angles, its lower margin

¹ Similar dentition is found in *M. turricula*, Pfr., of Cuba. See below, pl. XX., fig. 9.

² I use this generic name only temporarily. As suggested by von Martens, it must eventually be restricted to those species whose dentition is like that of *B. Guadelupensis*, the type of the genus.

incurved, its upper margin broadly reflected. The reflection is large and has subobsolete side cusps bearing well developed cutting points, and a short, stout median cusp, bearing a short, stout cutting point not quite reaching the lower margin of the base of attachment. The laterals are of the same general form as the

Fig. 67.

Lingual dentition of *Bulimulus dealbatus*.

centrals, but are larger, broader in proportion, and are rendered unsymmetrical by the suppression of the lower inner angle of the base of attachment, and inner side cusp and cutting point. The marginal teeth (fig. b) are but a simple modification of the laterals, formed by the proportionally greater development of the reflection in comparison with that of the base of attachment, and the greater development of the cutting points. On the extreme marginals the cutting points are shorter and much blunter (fig. c).

The dentition of *Bulimulus alternatus* is figured on p. 203 of L. and Frw. Shells, I. I have preserved no specimen from which I can more accurately draw the individual teeth. It has 75 rows of 37—1—37 teeth, all apparently of the same character as in *B. dealbatus*.

I have not examined *B. multilineatus*, *Dormani*, *Marielinus*, *Floridanus*, *patriarcha*, *Schiedeanus*.

c. Jaw in numerous distinct pieces, sometimes soldered together above, free and imbricated below. Marginal teeth quadrate. ORTHALICINÆ.

Genus **LIGUUS**, Montf.

Jaw thick, arcuate, ends rapidly attenuated, pointed; composite, being in numerous, separate, free, imbricated, triangular pieces, with sutures inclined obliquely to the centre of the jaw, so as to leave an upper median, angular piece; other pieces are soldered together above. Cutting edge with no median projection, serrated by the lower angles of the oblique pieces. For more detailed description see below, under *Orthalicus*, which has a similar jaw. I am

Fig. 68.

Jaw of *L. virgineus*.

not able to give a figure of the jaw of the only species found within our limits, *L. fasciatus*. It is however figured by Leidy (Terr. Moll. U. S., I., pl. V., fig. 4, *a, b*). It is similar to that of the allied species *L. virgineus*, which is here figured on p. 225.

The only species found within our limits, *L. fasciatus*, has about 69—1—69 teeth, judging from a membrane examined by me. That figured in L. and Frw. Shells, I., p. 214, has 94 rows of 55—1—55 teeth each. As elsewhere stated, there is often a difference in the number of transverse teeth in almost all species, and indeed upon different parts of the same membrane.

The central tooth (pl. VI., fig. E, *a*) has a base of attachment long and narrow, with strongly incurved sides, widely expanded, excurved and fringed lower margin, and upper margin less expanded, rounded, and broadly reflected. The reflection is stout and very rapidly narrows without any appearance of side cusps into a very broad, long, bluntly rounded median cusp, bearing a still broader, short, bluntly truncated cutting edge (as such a blunt organ cannot be called a point) reaching nearly to the lower edge of the base of attachment. It may be that I have here incorrectly considered the upper margin of the base of attachment as reflected and extended into the cusp. As in the case of the side teeth, I should, perhaps, rather say that the upper margin is not reflected, but that just below the middle of the base of attachment there springs up from its surface a broad, gouge-shaped cusp, bearing a still broader cutting edge (see pl. VI., fig. E, *d*, where the form of the cusp of the side teeth is shown by the profile). The side teeth run rapidly and obliquely backward from the central tooth, thus giving a chevron-like arrangement to the membrane. The teeth are crowded together both longitudinally and transversely, excepting as they approach the outer edges of the membrane, where they are much more separated.

I have used the term side teeth instead of lateral and marginal teeth, because it is difficult to decide which of these types they properly are. Taking into consideration the fact of there being distinct lateral teeth in the allied species, *L. virgineus*, and that the marginals of that species resemble the side teeth of *L. fasciatus*, I am inclined to believe we should consider all the side teeth of *fasciatus* as marginals. In this case we must consider that the lateral teeth are entirely suppressed. The marginals, as I have decided to call them, are of the same type as the centrals.

also examined the jaw of *O. obductus*, Shutt. (Ann. Lyc. N. H. of N. Y., XI., p. 37.) All these species have the same composite type of jaw.

The lingual dentition of *Orthalicus undatus* is so nearly similar to that of *Liguus fasciatus*, that I merely compare it with the description given above of that species. In *O. undatus* the central tooth (pl. VI., fig. D) is broader in proportion to its length; the base of attachment is less expanded at the upper margin, and very much less so at its lower margin, and the sides are not incurved; the cusp is stouter, longer, reaching the lower edge of the base of attachment, and it has subobsolete, but distinctly marked side cusps; the cutting edge is much more expanded, overlapping the next row of teeth. The first marginals differ from those of *L. fasciatus* in having a less developed cutting edge, the outer marginals have the side spurs to their cusps much more developed and even the cutting edge is trilobed. The extreme marginals are not so small. There are about 53—1—53 teeth, on one part of one membrane; a wide part of another membrane had 106—1—106.

All the species of *Orthalicus* enumerated above whose dentition is known have the same type of teeth as *O. undatus*, excepting *O. gallina-sultana*. This last (see Ann. Lyc. N. H. of N. Y., XI., 38, pl. IV., fig. A) is peculiar in having a long, stout cutting point with subobsolete side points to its central tooth, and three lateral teeth of same form but unsymmetrical. Thus in both *Liguus* and *Orthalicus* we find the usual type of dentition is not constant excepting as to the marginal teeth.

O. zebra. Too late for illustration I have received specimens from Key West, collected by Mr. W. W. Calkins. It is the form figured in Terr. Moll. U. S., IV., pl. LXXVIII., fig. 12, and copied in L. and Frw. Shells N. A., I., p. 216, fig. 370 (not fig. 371, which is referred by Fischer and Crosse to *O. melanochilus*, Val.). The jaw has 7—1—7 separate pieces. The lingual membrane has 126—1—126 teeth. The teeth are of same type as in *O. undatus*, but the cutting edge of the centrals and first laterals is shorter than the base of attachment. It is, perhaps, a variety of *undatus*.

Genus **PUNCTUM**, Morse.

But one species of this genus has been described, *P. pygmæum*, Dr., hitherto known in America as *Helix minutissima*, Lea. A

full account of its history with all published information relating to it has been given by Mr. Bland and myself in *Ann. of Lyc. Nat. Hist. of N. Y.*, X., 306. The jaw is low, wide, slightly arcuate,

Fig. 69.

Jaw of *F. pygmæum*. [Morse.]

with blunt, squarely truncated ends; it is composed of sixteen separate pieces, each higher than wide, with slightly overlapping edges; these pieces do not run obliquely towards the middle of the jaw,

there is, therefore, no appearance of an upper median triangular piece as in *Orthalicus* and *Liguus*.

The lingual membrane is long and narrow. There are 54 rows of 13—1—13 teeth each. The centrals have a base of attachment

Fig. 70.

Lingual dentition of *P. pygmæum*. [Morse.]

much longer than wide, expanded below and squarely truncated, very much narrowed above, reflected. The reflection is very small and has, according to Morse, one single cusp, but Schacko (*Malak. Blatt.* 1872, 178) describes the reflection in some European specimens as tricuspid.

Laterals of same form as centrals,

but with wider base of attachment in the first ones and bicuspid; outer laterals much narrower. There are no distinct marginals. All the teeth are decidedly separated.

I have not examined the jaw or lingual membrane of this species, but am entirely dependent on Morse for the descriptions and figures of the American form given above. While treating of the identity of the American and European forms in the paper referred to above, we have pointed out the differences in the jaw and membrane of the two forms, which, however, do not appear to be of specific value.

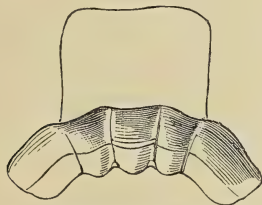
d. Jaw in a single piece, with an accessory, quadrate plate above. Marginal teeth quadrate. **SUCCININÆ.**

Genus **SUCCINEA**, Drap.

Jaw with an upper, quadrangular, accessory plate. The jaw is strongly arched, the ends acuminate in *S. avara* (fig. 71), blunt

in *obliqua*, *ovalis*, *Totteniana* (fig. 71), *campestris*, *lineata*, and *effusa*; there is a median projection to the cutting margin, sometimes broken by the ends of ribs. These ribs are found in *S. Totteniana* (3) (see fig. 71); *S. obliqua* (3-7); *ovalis* (over 7); I detected no ribs on that of *S. avara*, *lineata*, *campestris*, *Nuttalliana*, *Sillimani*, or *effusa*.

Fig. 71.



Jaw of *Succinea Totteniana*.
[Morse.]

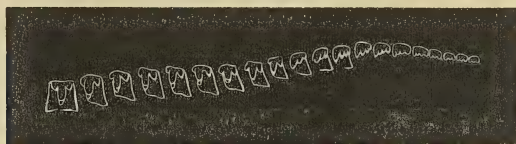
Fig. 72.



Jaw of *Succinea avara*.

The general arrangement of the lingual membrane is shown in fig. 73 of *S. avara*, while the characters of the separate teeth

Fig. 73.



Lingual dentition of *Succinea avara*.

are better seen in pl. XV., fig. 3. The peculiar character of the dentition is the cutting away or thinning of the middle portion of the lower edge of the base of attachment in the central teeth, and the inner lower lateral angle of the base of attachment in the laterals and still more in the marginals. The marginal teeth are also often peculiar in the denticulation of their reflected cusps. They have usually two small outer side cusps, the inner the smaller, each bearing cutting points proportioned to their size. The reflection of the teeth is also small in proportion to the base of attachment. In other respects the dentition of the genus is very much like that of the *Helicinæ*.

Succinea Sillimani (pl. XVII., fig. 12) has 24—1—24 teeth.

Succinea ovalis has not been examined by me. Morse gives 80 rows of 40—1—40 teeth.

Succinea lineata (pl. XV., fig. 11) has 26—1—26 teeth, with 4 perfect laterals, but the transition to marginals is very gradual. The teeth have a very broad base of attachment, and very slender, sharp cutting points.

Succinea avara (pl. XV., fig. 3) has 21—1—21 teeth, with about 8 perfect laterals. Morse counted 19—1—19 teeth.

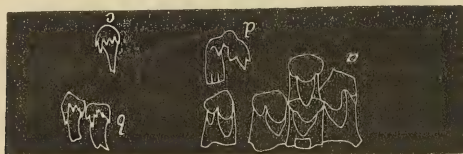
Succinea obliqua (pl. XV., fig. 4) has 43—1—43 teeth, with 10 perfect laterals.

Succinea Totteniana is said by Morse, whose figure is given in L. and Frw. Shells, I., p. 267, to have 100 rows of 33—1—33 teeth. The bases of attachment are very narrow.

Succinea campestris (pl. XV., fig. 10) has 18—1—18 teeth, with about 10 perfect laterals. Morse gives 50 rows of 30—1—30. The central tooth has a peculiarly narrow base of attachment, and a very greatly developed median cusp, the side cusps being subobsolete.

Succinea Nuttalliana (fig. 74). Teeth 19—1—19.

Fig. 74.



Succinea effusa (pl. XV., fig. 6) has 15—1—15 teeth, with 10 perfect laterals.

Succinea Stretchiana (pl. XX., fig. 7). 16—1—16. 8 laterals.

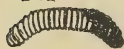
I have had no opportunity of examining the other species of *Succinea* found within our limits.

Family VERONICELLIDÆ.

Genus **VERONICELLA** Blainv.

Jaw (fig. 75) low, wide, thick, slightly arcuate; ends but little attenuated, blunt; cutting margin without median projection; anterior surface with numerous, stout, crowded ribs, denticulating either margin, 24 in *V. Floridana*.

Fig. 75.



Jaw of
Veronicella
Floridana.

Lingual membrane, as seen in fig. 76, is arranged as usual in the *Helicinæ*, the transverse rows being

almost horizontal. By fig. 11 of pl. XVII., representing *V. Floridana*, it will be seen that the teeth are of a very peculiar type.

The lingual membrane is long and very broad, comprising (in the Florida species) about 60—1—60 teeth. The centrals have their base of attachment quite small, long and narrow, attenuated to a point above, gradually enlarging toward the base, above which are lateral, bluntly pointed, wing-like expansions; the lower margin is broad, and has a deep, rounded excavation; in some cases the lateral expansions are so produced as to give an almost cruciform appearance to the base of attachment; below the centre of the base of attachment, on its anterior surface, is a stout, blunt, short, simple cusp, ending in a short, stout cutting point.

Fig. 76.



Lingual dentition of *Veronicella Floridana*.

The lateral teeth are very irregular in shape, but retain the bicuspid character peculiar to the *Geophila*; they are longer and much wider than the centrals; the bases of attachment are very irregular in shape, very unsymmetrical, subquadrate or irregularly excavated above, thence curve outwards and downwards, until at their lower extremity they exhibit the lateral expansions and basal excavation of the central tooth, but both these characters are much more developed than in the centrals, and from the want of symmetry in the teeth, are found only on the outer side of each tooth; the upper edge is squarely reflected, the reflection is very large, extends half way to the lower edge of the base of attachment, and is produced beyond that into a blunt, stout cusp bearing a stout cutting point; the side cusps are almost obsolete, the inner one is much larger than the outer one, neither with distinct cutting point. The marginal teeth are a simple modification of the laterals, being reduced to a subquadrate shape, with the cutting point of the cusp much more produced.

I give on pl. XVI., fig. 11, a group of centrals and laterals in *a*, a marginal in *b*.

I have not been able to examine *V. olivacea*, the only other species found within our limits.

The species of the genus foreign to the United States hitherto examined agree in their jaw and lingual dentition with *V. Floridana*.

EXPLANATION OF THE PLATES.

PLATE I.

- Fig. 1. *Glandina truncata*, Say.
a. Central and adjacent marginals.
b. The twentieth tooth.
c. The last tooth.
- Fig. 2. *Macrocyclus Duranti*, Newc.
a. Central and adjacent teeth.
b. The last two teeth.
- Fig. 3. *M. concava*, Say.
a. Central and adjacent teeth.
b. The last ten teeth.
c. The last tooth from another part of the membrane.
- Fig. 4. *M. Vancouverensis*, Lea.
a. Central and adjacent teeth.
b. The last five teeth.
c. The first lateral seen from above on a different scale of enlargement.
- Fig. 5. *M. Voyana*, Newc.
a. Central and adjacent teeth.
b. Extreme marginals.

NOTE.—This plate must be studied in connection with the descriptions in the text. It will there be seen that Fig. 2*a* and Fig. 4*a* are taken from below, to better show the base of attachment. Figs. 3*a*, 5*a*, and 4*c* are taken from above, and more correctly show the form of the cusp.

PLATE II.

- Fig. 1. *Zonites lævigatus*, Pfr. The central tooth with all the teeth to the right of it.
- Fig. 2. The same, more highly enlarged, to the fifth tooth.
- Fig. 3. *Zonites cellarius*, Müll. Same reference as in fig. 1.
- Fig. 4. *Zonites friabilis*, W. G. B.
a. Central and adjacent lateral.
b. Extreme marginals from two adjacent rows.
- Fig. 5. *Zonites inornatus*, Say.
a. Central and first three laterals.
b. Marginal tooth fourth from the end.

Fig. 6. *Zonites capnodes*, W. G. B.

a. Central and first lateral.

b. Marginal teeth.

Fig. 7. *Zonites fuliginosus*, Griff.

a. Central and first lateral.

b. Third marginal from edge of lingual membrane.

PLATE III.

Fig. 1. *Zonites gularis*, Say.

a. Central and first lateral tooth.

b. Marginal tooth.

Fig. 2. *Zonites sculptilis*, Bland.

b. Extreme marginals.

Fig. 3. *Zonites limatulus*, Ward.

Fig. 4. *Zonites capsella*, Gould.

Fig. 5. *Zonites Elliotti*, Redf.

b. An extreme marginal.

Fig. 6. *Zonites demissus*, Binn.

Fig. 7. *Zonites lasmodon*, Phillips.

c. Last marginal but three.

Fig. 8. *Zonites intertextus*, Binn.

Fig. 9. *Zonites internus*, Say.

b. The 16th and 17th tooth.

c. The 25th tooth.

Fig. 10. *Zonites Gundlachi*, Pfr.

b. A group of marginals.

Fig. 11. *Zonites ligerus*, Say.

Fig. 12. *Zonites capnodes*, W. G. B.

a, b, c, d. The base of attachment.

e. The reflection.

f, f. The obsolete side cusps.

g, g. The side cutting points.

h. The central cusp.

i. Central cutting point.

PLATE IV.

Fig. 1. *Limax flavus*, Lin.

a. Central and first lateral teeth.

b. Marginal tooth before the bifurcation commences.

c. An extreme marginal, to show the bifurcation of the marginals.

Fig. 2. *Limax Hewstoni*, J. G. Coop.

- a. Central and first lateral teeth.
- b. Extreme marginals.

Fig. 3. *Limax agrestis*, Lin.

- a. Central and first lateral teeth.
- b. First marginal teeth.
- c. Last three marginals.

Fig. 4. *Limax maximus*, Lin.

- a. A group of central and adjacent laterals.
- b. A marginal tooth before the commencement of the bifurcation.
- c. An extreme marginal, showing the bifurcation.

Fig. 5. *Limax campestris*, Binney. Same references as in fig. 1.Fig. 6. *Vitrina Pfeifferi*, Newc.

- a. Central and lateral teeth.
- b. Extreme marginal.

Fig. 7. *Vitrina exilis*, Mor.

- a. Central and lateral teeth.
- b. First marginals.
- c. Last marginals.

Fig. 8. *Vitrina limpida*, Gould. Same references as in fig. 6.

PLATE V.

Fig. 1. *Ariolimax Californicus*, J. G. Cooper.

- a. Central and first lateral teeth.
- b. Marginal teeth.

Fig. 2. *Ariolimax niger*, J. G. Cooper. Extreme marginal teeth of an exceptional form.Fig. 3. *Ariolimax niger*, J. G. Cooper. Same references as in fig. 1.Fig. 4. *Prophysaon Hemphilli*, Bl. and Binn. Same references as in fig. 1.Fig. 5. *Arion hortensis*, Fér. Same references as in fig. 1.

- c. Extreme marginal.

Fig. 6. *Ariolimax Columbianus*, Gld.

- a. Central and first lateral teeth.
- b. c. Transition teeth from laterals to marginals.
- d. Marginal tooth.
- e. Extreme marginal tooth.
- f. Marginal tooth in profile.

Fig. 7. *Hemphillia glandulosa*, Bl. and Binn.

- a. Central and first lateral teeth.
- b. Transition from lateral to marginal teeth.
- c. Marginal teeth near the edge of the membrane.
- d. Extreme marginal tooth.

PLATE VI.

Fig. A. *Tebennophorus Caroliniensis*, Bosc.

- a. The central tooth.
- b. The first lateral.
- c. The last laterals.
- d. Marginal teeth.
- e. Extreme marginals.

Fig. B. *Pallifera Wetherbyi*.

- a. Central and lateral tooth.
- b. Extreme marginals.

Fig. C. *Pallifera dorsalis*, Binn.

- a. Central and two lateral teeth.
- b. Marginal tooth.
- c. Extreme marginal.

Fig. D. *Orthalicus undatus*, Brug. The central and first, second, fifteenth, forty-eighth, and fiftieth marginals.Fig. E. *Liguus fasciatus*, Müll.

- a. A group of central and marginal teeth.
- b. Marginal far removed.
- c. An extreme marginal.
- d. A marginal in profile.

PLATE VII.

Fig. 1. *Patula strigosa*, Gld.

- a. Central and lateral teeth.
- b. Marginal teeth.
- c. Outer marginal tooth.
- d. An outer lateral on a different scale of enlargement.
- e. A central tooth from an embryonic specimen.

Fig. 2. *Patula Cooperi*, W. G. B.

- a. Central and lateral.
- b. Outer marginals.

Fig. 3. *Patula perspectiva*, Say.Fig. 4. *Patula Idahoensis*, Newc.

- Fig. 5. *Patula alternata*, Say.
Fig. 6. *Patula Hemphilli*, Newc.
Fig. 7. *Patula alternata*, Say. Var. *mordax*, Shuttl.
Fig. 8. *Patula Cumberlandiana*, Lea.
Fig. 9. *Patula solitaria*, Say.
Fig. 10. *Patula striatella*, Anthony.

PLATE VIII.

- a.* Central and lateral teeth.
b. The last lateral tooth.
c. Inner marginal teeth.
d. Outer marginal teeth.

- Fig. 1. *Helix Texasiana*, Mor.
Fig. 2. *Helix Troostiana*, Lea.
Fig. 3. *Helix uvulifera*, Shuttl.
Fig. 4. *Helix espiloca*, Rav.
Fig. 5. *Helix Hazienda*, Bl.
Fig. 6. *Helix septemvolva*, Say.
Fig. 7. *Helix Febigeri*, Bl.
Fig. 8. *Helix pustula*, Fér.
Fig. 9. *Helix auriformis*, Bl.
Fig. 10. *Helix Mooreana*, W. G. B.
Fig. 11. *Helix fastigans*, L. W. Say.
Fig. 12. *Helix auriculata*, Say.

PLATE IX.

- Fig. 1. *Helix Edwardsi*, Bland.
a. Central and first lateral.
b. Marginal.
c. Extreme marginal.
Fig. 2. *Helix polygyrella*, Bland. Same references.
Fig. 3. *Helix Yatesi*, J. G. Coop. Same references.
Fig. 4. *Helix monodon*, Rack. Same references.
Fig. 5. *Helix germana*, Gld. Same references.
Fig. 6. *Helix hirsuta*, Say.
b. Transition from laterals to marginals.
Fig. 7. *Helix stenotrema*, Fér.
a. Central and lateral teeth.
b. Extreme marginals.
Fig. 8. *Helix spinosa*, Lea.
Fig. 9. *Helix barbigeri*, Redf. References as in fig. 6.

PLATE X.

- Fig. 1. *Helix tridentata*, Say.
Fig. 2. *Helix palliata*, Say.
 a. Central and first lateral.
 b. An outer lateral.
 c. A transition tooth between laterals and marginals.
 d. A marginal tooth.
Fig. 3. *Helix Rugeli*, Shuttl.
Fig. 4. *Helix inflecta*, Say.
Fig. 5. *Helix fallax*, Say.
Fig. 6. *Helix Hopetonensis*, Shuttl.
 b. Marginal teeth.
Fig. 7. *Helix appressa*, Say.

PLATE XI.

- a.* Central and lateral.
 b. Inner marginal.
 c. Outer marginal.
 d. Transition from lateral to marginal.
Fig. 1. *Helix albolabris*, Say.
Fig. 2. *Helix Wetherbyi*, Bl.
Fig. 3. *Helix Roemeri*, Pfr.
Fig. 4. *Helix Downieana*, Bl.
Fig. 5. *Helix Sayii*, Binn.
Fig. 6. *Helix Clarki*, Lea.
Fig. 7. *Helix exoleta*, Binn.

PLATE XII.

- Fig. 1. *Helix elevata*, Say.
Fig. 2. *Helix Columbiana*, Lea.
Fig. 3. *Helix Mobiliana*, Lea.
 b. Extreme marginals.
Fig. 4. *Helix devia*, Gld.
 a. Central and lateral tooth.
 b. An extreme lateral.
 c. Marginal teeth.
 d. The last marginal.
Fig. 5. *Helix profunda*, Say.
Fig. 6. *Helix multilineata*, Say.

- Fig. 7. *Helix clausa*, Say.
 b. Marginal teeth.
 c. Extreme marginals.
Fig. 8. *Helix dentifera*, Binney.
 b. Marginal tooth.

PLATE XIII.

- Fig. 1. *Hemitrochus varians*, Mke.
 a. Central and first lateral teeth.
 b, c. Marginal teeth.
Fig. 2. *Helix griseola*, Pfr. Same references.
Fig. 3. *Helix Stearnsiana*, Gabb.
 a. Group of central and lateral teeth.
 b. Group of teeth showing transition from laterals to marginals.
 c. A group of extreme marginal teeth.
Fig. 4. *Helix Kelletti*, Forbes.
 a. Central and first lateral tooth.
 b. Transition from laterals to marginals.
 c. Extreme marginal tooth.
Fig. 5. *Helix lineata*, Say. Same references as in fig. 1.
 b. Marginal tooth.
Fig. 6. *Helix Newberryana*, W. G. B. Same references as in fig. 4.
Fig. 7. *Helix aspersa*, Müll. Same references as in fig. 4.
Fig. 8. *Helix fidelis*, Gray. Same references as fig. 4.
Fig. 9. *Helix infumata*, Gld.
 a. Central and first lateral tooth.
 b, c. Transition teeth from different parts of the membrane.
 d. Extreme marginal teeth.

PLATE XIV.

- a.* Central and lateral teeth.
 b. Transition from laterals to marginals.
 c. Inner marginal teeth.
 d. Outer marginal teeth.
Fig. 1. *Helix tudiculata*, Binn.
Fig. 2. *Helix arrosa*, Gld.
Fig. 3. *Helix ruficincta*, Newc.
Fig. 4. *Helix Traski*, Newc.
Fig. 5. *Helix sequoicola*, J. G. Coop.

- Fig. 6. *Helix Ayresiana*, Newc.
 Fig. 7. *Helix redimita*, W. G. B.
 Fig. 8. *Helix Nickliniana*, Lea.
 Fig. 9. *Helix ramentosa*, Gld.
 8. The eighth tooth—an outer lateral.
 Fig. 10. *Helix exarata*, Pfr.

PLATE XV.

- a.* Central and lateral teeth.
b. Inner marginal tooth.
c. Outer marginal tooth.

- Fig. 1. *Macroceramus Gossei*, Pfr.
 Fig. 2. *Pupa rupicola*, Say.
 Fig. 3. *Succinea avara*, Say.
 Fig. 4. *Succinea obliqua*, Say.
 Fig. 5. *Stenogyra decollata*, Lin.
 Fig. 6. *Succinea effusa*, Shuttl.
 Fig. 7. *Bulimulus dealbatus*, Say.
 Fig. 8. *Stenogyra subula*, Pfr.
 Fig. 9. *Cœcilianella subcylindrica*, Lin.
 Fig. 10. *Succinea campestris*, Say.
 Fig. 11. *Succinea lineata*, W. G. B.
 Fig. 12. *Pupa fallax*, Say.

PLATE XVI.

Jaw of:—

- Fig. 1. *Stenogyra subula*, Pfr.
 Fig. 2. *Arion hortensis*, Fér.
 Fig. 3. *Vitrina limpida*, Gld.
 Fig. 4. *Helix Newberryana*, W. G. B.
 Fig. 5. *Ferussacia subcylindrica*, L.
 Fig. 6. *Hemphillia glandulosa*, Bl. and Binn.
 Fig. 7. *Pupa rupicola*, Say.
 Fig. 8. *Helix aspersa*, Müll.
 Fig. 9. *Prophysaon Hemphilli*, Bl. and Binn.
 Fig. 10. *Helix Yatesi*, J. G. Cooper.
 Fig. 11. *Helix polygyrella*, Bl. and J. G. Coop.
 Fig. 12. *Bulimulus sufflatus*, Gld.
 Fig. 13. *Orthalicus undatus*, Brug.
 Fig. 14. *Helix griseola*, Pfr.

PLATE XVII.

Central, lateral, and outer marginal teeth of:—

- Fig. 1. *Zonites multidentatus*, Binn.
- Fig. 2. *Zonites suppressus*, Say.
- Fig. 3. *Zonites indentatus*, Say.
- Fig. 4. *Zonites arboreus*, Say.
- Fig. 5. *Zonites fulvus*, Drap.
- Fig. 6. *Zonites viridulus*, Mke.
- Fig. 7. *Zonites nitidus*, Müll.
- Fig. 8. *Zonites milium*, Morse.
- Fig. 9. *Zonites ferreus*, Morse.
- Fig. 10. *Veronicella Floridana*, Binn.
- Fig. 11. *Succinea Sillimani*, Bland.

PLATE XVIII.

- a. Central and lateral teeth.
- b. Transition from laterals to marginals.
- c. Inner marginal teeth.
- d. Outer marginal teeth.

- Fig. 1. *Helix Wheatleyi*, Bland.
- Fig. 2. *Helix thyroides*, Say.
- Fig. 3. *Helix Pennsylvanica*, Green.
- Fig. 4. *Helix loricata*, Gld.
- Fig. 5. *Helix Mitchelliana*, Lea.
- Fig. 6. *Helix pulchella*, Müll.
- Fig. 7. *Helix labyrinthica*, Say.
- Fig. 8. *Helix Townsendiana*, Lea.
- Fig. 9. *Helix asteriscus*, Morse.
- Fig. 10. *Helix obstricta*, Say.

NOTE.—The following typographical errors in the earlier pages of this paper should be carefully corrected:—

- p. 141, third line from bottom, for *Paluta* read *Patula*.
- p. 146, line 11, for former read latter.
- p. 147, line 20, for *Anaderus* read *Anadenus*.
- p. 148, line 12, for *Simpulopsus* read *Simpulopsis*.
- p. 153, line 17 from bottom of right hand column, for *Terussacia* read *Ferussacia*.
line 16, for *Cæcilianella* read *Cœcilianella*; also on p. 186.
- p. 154, line 11 of left hand column, for *Columbianaus* read *Columbianus*.
- p. 155, note, for *ptychoptora* read *ptycophora*.

p. 180, line 13, for 5 read 8.

p. 191, line 5 from bottom, for Colkett read Calkins.

p. 165, line 19, *Z. cerinoideus*. Jaw as usual. Teeth 34—1—34, with 9 perfect laterals. Charleston, S. C. (W. G. Masyek.)

p. 171. Note. *Z. cerinoideus* also has these characteristics of *Zonites*.

p. 176, line 15, add: excepting in the absence of the peculiar inner side cutting point of that species.

p. 186. *Cœcilianella*. Since the above was printed, I have had an opportunity, thanks to Mr. Bland, of examining the jaw and lingual membrane of *C. Gundlachi* of St. Martin. The jaw has decided, numerous, broad, flat, slightly separated ribs, denticulating either margin.

In the plates the inner cutting point should have been bifid in pl. X. fig. 1, 16th tooth. (The fourth figure from the right is the 10th tooth.) Fig. 3, *d*. Pl. XI. fig. 1, *b*. Pl. XII. fig. 1, 31st tooth.

Helix ruficincta, pl. XIV. fig. 3. Another membrane has cutting points on all the laterals.

Helix exoleta. Two of four membranes recently examined have side cutting points to outer laterals; the inner cutting point of marginals are also bifid.

ON THE LINGUAL DENTITION AND GENITALIA OF *PARTULA* AND OTHER PULMONATA.

BY W. G. BINNEY.

I owe to the kindness of Dr. W. D. Hartman, of West Chester, Pennsylvania, the opportunity of examining numerous species of *Partula*. The specimens were received by him directly from Mr. Garrett. Their identification is that of the latter, and may be relied upon on account of his relations with Mr. Pease. Of their value as distinct species, however, I have nothing to say. So labelled were *Partula fusca*, Pease; *P. citrina*, Pease; *P. planilabrum*, Pease; *P. abbreviata*, Pease; *P. umbilicata*, Pease; *P. bilineata*, Pease; *P. amanda*; *P. virginea*, Pease; *P. gracilis*. Each of these were represented by several specimens still remaining in their shells. Each species was in a separate bottle, great care being taken to preserve their identity and prevent intermingling of species.

In addition to the above nine so-called species, there was one large bottle containing many specimens of the following: *Partula rosea*, Brod.; *P. formosa*, Pease; *P. ? lugubris*; *P. varia*, Brod.; *P. compacta*, Pease; *P. Garretti*, Pease; *P. ? dentifera*, Pease; *P. crassilabris*, Pease; *P. Hebe*, Pfr.; *P. protea*, Pease; *P. globosa*, Pease; *P. approximata*, Pease; *P. turgida*, Pease; *P. faba*, Martyn. As the species of the above lot were not separately indicated, the specimens are of value only as throwing light upon the generic characters of *Partula*. Especially as proving the constancy of the peculiar dentition of the lingual membrane, they serve an excellent purpose. To this end I have examined the membrane of all of the specimens in the bottle. The result of the examination will be given below.

The external characters of all the species agree. The animal is blunt before. The tail is long and gradually acuminate. There is no caudal mucus pore, no parallel furrows along the side of the foot, no distinct locomotive disk. The labial processes and the collar seem unusually developed. The anal and respiratory orifices are situated as usual in the shell-bearing Geophila. The genital orifice is close behind and below the right eyepeduncle. The tentacles are present in all the species, protruding in

many specimens as fully as the eyepeduncles, in others inverted, but plainly visible on opening the head, and their position indicated exteriorly by a depression on the surface so plainly that I wonder at their having been overlooked by Férussac.

I have observed nothing remarkable in the nervous, respiratory, or alimentary systems.

The jaw, as already stated by me (Ann. Lyc. of Nat. Hist. of N.Y., XI. 45), is very thin, transparent, light horn-colored; slightly arcuate, its ends often gradually attenuated; in some specimens is a transverse, arched line of reënforcement above, but not parallel to, the cutting margin; there is no appearance of a median projection to the cutting margin; the whole anterior surface, even to the ends, is furnished with delicate, narrow, separated ribs, of the type well known in *Cylindrella*, *Macroceramus*, *Pineria*, *Gæotis*, *Amphibulima*, and many species of *Bulimulus*, their ends decidedly breaking the continuity of either margin: these ribs run obliquely to the median line of the jaw, so that at the centre they form a triangular space over which are (in one specimen of *P. gracilis*, some ten) ribs of unequal length, which do not reach the lower margin; there is, however, no distinct triangular compartment or separate piece, as in *Liguus* and *Orthalicus*. I have found this form of jaw in *P. fusca*, *citrina*, *planilabrum*, *abbreviata*, *umbilicata*, *amanda*, *virginea*, *bilineata*, and *gracilis*. I have not observed the jaw in all of the specimens of the species enumerated on p. 244, but in many of them which I have examined it proved the same as described above. The jaw differs in the various species in the more or less attenuation towards the ends, and also in the number of the ribs, thus in *virginea* and *gracilis* there are over 60, in *bilineata* I found but 50, while in one of the unnamed individuals I found only about 36. This last I have figured (pl. XIX., fig. 5) to show the general form of the jaw. The character of the ribs is better shown in the more enlarged view of the end of the jaw of *P. virginea* (fig. 11), while the disposition of the ribs at the centre of the jaw is shown in fig. 6 of *P. gracilis*.

The lingual membrane is broad. The central teeth (pl. XIX., fig. 4, of that of *P. amanda*) have a base of attachment long and narrow, squarely reflected above, the lower edge incurved, with slightly produced lateral expansions; the reflection is large and stout, with obsolete side cusps bearing decided, triangular cutting

points, and a stout middle cusp bearing a stout cutting point which reaches to the lower edge of the base of attachment. The lateral teeth are longer and broader than the central tooth; they are unsymmetrical by the suppression of the inner cusp and cutting point, and the lower half of the base of attachment being thrown off towards the outer edge of the membrane, though its inner lower lateral expansion is not suppressed; the outer side cusp is well developed and bears a short distinct cutting point; the inner cusp is very stout and bears a very stout cutting point extending slightly beyond the lower edge of the base of attachment. The change from the lateral to the marginal teeth is formed by the lesser size of the reflected portion and the greater development of the inner cutting point, as well as by the blunt bifurcation of the outer cutting point. The marginal teeth have their base of attachment long and narrow, quadrangular, curving outward, prolonged above the reflection, which is small, but bears a highly developed cutting point obliquely and bluntly bicuspid on its outer edge, the inner division much the larger. The number of perfect laterals varies somewhat. I counted seven in *citrina*, eleven in *planilabrum*, ten in *abbreviata* and *amanda*, eight in *umbilicata*, *virginea*, and *bilineata*, five only in *gracilis*. The number of marginal teeth also varies, but they are numerous in all the species; in *virginea* I counted over one hundred and twenty. Excepting that some of the membranes had narrower teeth than others, I found no difference in them. They all agree (including those of the species named on p. 244) with the figure given by Heynemann (Mal. Blatt. 1867, t. i. fig. 1-1a.) of the dentition of *P. lirata*.

The genital system of one of the undetermined specimens is given on pl. XIX., fig. 1. The ovary (*ov.*) is small and stout; the epididymis (*ep.*) is short and greatly convoluted at the end nearer the oviduct; the testicle (*t.*), composed of short cœca, is small and embedded in the upper lobe of the liver in the very apex of the shell; the oviduct (*ovid.*) is long, convoluted; the vas deferens (*v. d.*) enters the prostate high up on the oviduct, not at its lower end, as usual; it runs down to the external orifice, then up to near the end of the penis sac, where it enters; the vagina (*v.*) is long, greatly swollen at the entrance of the duct of the genital bladder; the last mentioned organ (*g. b.*) is small, with a short duct which enlarges greatly before entering the vagina; the penis sac (*p. s.*) is large, long, bluntly terminating, with a decided constriction

about its centre. In the other species examined, the retractor muscle is inserted at the end of the penis sac. The same general arrangement is found in the other species examined, *bilineata* (fig. 10), *fusca* (fig. 9), *virginea* (fig. 8), *umbilicata* (fig. 7), and in *abbreviata*, *citrina*, *planilabrum*, *amanda*. In *P. virginea* the constriction of the penis sac is much narrower and longer; the upper portion might be considered rather as a swelling of the vas deferens. In most of the specimens examined there were well formed shells of too full whorls in the oviduct, leading me to believe the genus viviparous. Thus I found embryonic young (usually only two) in *planilabrum*, *abbreviata*, *umbilicata*, *bilineata*, *amanda*, and *virginea*. Those less grown were enveloped in a sack. In *gracilis*, however, I found five white, calcareous eggs. They contained, however, shells of two whorls, so that even if this species actually lays the egg, it can only be at the moment the young animal is ready to break it. In many of the undetermined species, also, I found well formed eggs, and in some of them there were these eggs, and also embryonic young not protected by eggs. I suspect, therefore, that the young is actually brought forth living in *all cases*.

This closes my account of *Partula*. I add descriptions of several species of Pulmonata, whose dentition has not yet been published. As each lingual membrane is illustrated by a figure, I have not considered it necessary to give a detailed description.

Macrocyclus euspira, Pfr. (*Hyalina* of von Martens, p 72.)

Extracted from a dry specimen in the cabinet of Mr. Swift by Mr. Thomas Bland. Ann. L. N. H. N. Y., XI. 73.

Jaw low, crescentic, ends pointed; cutting margin with a decided, sharp median projection.

Lingual membrane long and narrow. Teeth arranged as in *Macrocyclus* (see ante, p. 158). There are, however, no transition teeth as in the American species, all the side teeth being true marginals of the aculeate type. Teeth 30—1—30 (pl. XXI., fig. 3). The centrals are deeply emarginate at the upper edge of their base of attachment, and have expanded lower lateral angles; they have also a well-marked simple median cusp with a decided cutting point.

The species is placed by Von Martens in *Ammonoceras*, a sub-genus of *Hyalina*.

Nanina subcircula, Mousson.

Raiatea, Society Islands, Mr. Garrett to Dr. W. D. Hartman.

Jaw not observed.

Teeth (pl. XX., fig. 1) with obsolete side cusps, but distinct cutting points on the centrals. Laterals unsymmetrical as usual by the suppression of the inner cutting point, and inner lower lateral expansions to the base of attachment. Marginals aculeate, bifid.

The species is viviparous.

Endodonta tumuloides, Garrett.

Raratonga I., Cook's Isle. Received from Dr. W. D. Hartman, who received it from Mr. Garrett.

Teeth 17—1—17, with about 7 perfect laterals (pl. XXI., fig. 6). The base of attachment of the centrals is subequilateral. There are distinct side cutting points and cusps. The median cusp is long. Laterals unsymmetrical as usual. Transition formed as usual. Marginals low, wide, with one long, large, bifid inner cutting point and one small side cutting point.

Jaw not observed.

Helix astur, Souv.

New Caledonia, Mr. Thomas Bland.

Jaw (pl. XX., fig. 11) low, wide, slightly arcuate; ends scarcely attenuated, blunt; anterior surface without ribs; a wide, blunt, median projection to the cutting edge; a line of reënforcement running above, and parallel to, the cutting margin; a strong muscular attachment to the upper margin.

Lingual membrane (pl. XX., fig. 12) with 30—1—30 teeth, with about 9 perfect laterals. Centrals (*a*) with square base of attachment, well-developed side cusps and cutting points; laterals same as centrals, but unsymmetrical as usual; transition to marginals formed as usual (*b*); marginals (*c*) low, wide, with one inner, long, broad, bifid cutting point, and one outer, small cutting point; those figured (*c*) are extremes.

Helix (*Thelidomus*) **auricoma**, Fér.

Lomas de Camoa, Cuba. Mr. Arango to Mr. Bland.

Jaw arched, with blunt, scarcely attenuated ends; 12 broad ribs distributed over the whole anterior surface and denticulating either margin; no median projection to the cutting margin.

Lingual membrane (pl. XXI., fig. 5), with 42—1—42 teeth, of

which about 25 may be called laterals, but the change to marginals is hardly marked, these last differing only in being smaller, in having a more square base of attachment, and in having more obtuse and more proportionally developed cutting points; there is no splitting of the inner cutting point of the marginals. The centrals have subobsolete side cusps, but decided side cutting points; the central cusp is short and stout, the base of attachment has greatly expanded lower lateral angles. Laterals like the centrals, but unsymmetrical as usual.

The dentition of this species resembles that of *provisoria* and *notabilis* of the same subgenus.

The genitalia are figured on pl. XIX., fig. 3. The penis sac (*p. s.*) is stout, rounded, with long, pointed apex; the vas deferens (*v. d.*) enters it below the apex; the retractor muscle (*r.*) is inserted in the vas deferens just before it enters the penis sac. The genital bladder (*g. b.*) is short, cylindrical, with blunt end; its duct is short and small. The penis sac enters the vagina opposite the entrance of the genital bladder.

Helix (*Carocolus*) *sagemon*, Beck.

Cuba. Mr. Arango to Mr. T. Bland.

Jaw high, arcuate, ends rapidly but slightly attenuated, blunt; cutting margin with broad, blunt, median projection; no anterior ribs.

Lingual membrane (pl. XXI., fig. 4) very long and narrow, with 36—1—36 teeth, the transverse rows of teeth being unusually oblique. The change from laterals to marginals is so gradual that it is difficult to say how many of the former there are. Centrals with base of attachment long, constricted at the middle, expanded above and with greatly produced lower lateral expansions; reflection large, with obsolete side cusps and no side cutting points, and with a very broad, short median cusp, bearing a short, widely expanded, square cutting edge (as it cannot be called a *point*). Laterals like the centrals, but unsymmetrical as usual, and with an unsymmetrical cutting edge larger than in the central tooth. The cutting edge becomes more developed as the teeth pass off laterally, in proportion to the base of attachment and the cusp also. Thus the marginals become formed without any splitting of the inner cutting point, or any development of a side cusp and

cutting point. This is better shown in the figures than can be expressed in words.

The genitalia of this species is figured on pl. XIX., fig. 2. The testicle (*t*) is small and imbedded in the upper lobe of the liver; the epididymis (*ep.*) is long and greatly convoluted near its junction with the oviduct; the accessory gland (*acc.*) is composed of several tubular cæca of unequal length; the ovary (*ov.*) is very large and sabre-shaped; the oviduct (*ovid.*) is narrow, but slightly convoluted; the genital bladder (*g. b.*) is large, globular, with a short, stout duct entering the vagina at about the middle of its length; the penis sac (*p. s.*) is large, with a central constriction, tapering towards the apex, where the vas deferens (*v. d.*) enters, and bearing the insertion of the retractor muscle (*r.*) below its apex; it enters the cloaca close to the external orifice.

Helix (*Caracolus*) *Arangiana*, Poey.

Cuba. Mr. Arango to Mr. Thomas Bland.

Jaw (pl. XXI., fig. 2) greatly arched, ends blunt, scarcely acuminate; anterior surface without ribs; cutting margin with a blunt median projection.

Lingual membrane very long and narrow (pl. XXI., fig. 1), with 33—1—33 teeth, of same type as in *H. sagemon* (see above). The lower edge of the base of attachment appears delicately fringed.

Genitalia as in *H. sagemon* (see above).

Helix (*Pomatia*) *Sieboldtiana*, Pfr.

Japan. Received from Dr. W. D. Hartman.

Jaw high, arched, ends but little attenuated, blunt; anterior surface with eight stout, separated ribs, denticulating either margin; no median projection to the cutting margin.

Lingual membrane long and narrow (pl. XXI., fig. 8); teeth 39—1—39, with 21 perfect laterals; centrals with base of attachment long, narrow, the lower lateral angles somewhat expanded, but blunt; median cusp long, stout, cutting point stout, blunt, not reaching the lower edge of the base of attachment; side cusps obsolete; no side cutting points. Laterals like the centrals, but longer and wider, and unsymmetrical as usual; the fifteenth lateral has a side cutting point. The transition to marginals formed as usual by the greater proportional development and splitting of the cutting point. Marginals low, wide, with one broad, oblique, bluntly bifid cutting point, and one short, side cutting point.

The species is placed by Von Martens in *Acusta*, a subgenus of *Nanina*, judging from shell alone.

***Helix convicta*, Cox.**

Australia. Received from Dr. Cox by Dr. W. D. Hartman.

Jaw high, arcuate, thick; ends but little attenuated, blunt; no median projection to cutting edge; anterior surface with 7 separated, stout ribs.

Lingual membrane (pl. XXI., fig. 7) with 30—1—30 teeth, with 10 laterals. The centrals and inner laterals have no side cutting points. Transition to marginals as usual (see last species). Marginals low, wide, with one short, broad, bifid inner cutting point, and one small, side cutting point.

***Helix (Dorcasia) pyrozona*, Phil.**

"Outside the great wall of China." Lieut. Wild, U. S. N., to Dr. W. D. Hartman.

Jaw as in *Pomatia* (see above, *H. Sieboldtiana*). Ribs few, stout.

Lingual membrane (pl. XX., fig. 8), with 28—1—28 teeth, with 10 perfect laterals. It is difficult to distinguish any cutting points on the obsolete side cusps of centrals and inner laterals. The general characters of the teeth are as in *H. Sieboldtiana* (see above).

***Stenogyra hasta*, Pfr.**

Cuba. Received from Mr. Bland.

Jaw (pl. XX., fig. 2) low, arcuate, ends somewhat attenuated, blunt; no median projection to cutting margin; anterior surface with numerous delicate striæ.

Lingual membrane (pl. XX., fig. 3) as usual in the genus (see ante, p. 187). There are 18—1—18 teeth.

The species was formerly described as a *Balea*. This examination of the jaw and dentition shows its correct position to be in *Stenogyra*.

***Macroceramus turricula*, Pfr.**

Lomas de Camoa, Cuba. Mr. Arango to Mr. Bland.

Jaw as usual in the genus (see ante, p. 223). Ribs 35.

Lingual membrane (pl. XX., fig. 9) as in *M. Gossei*, Pfr. (see above), not as in *Cylindrella*.

***Cylindrella (Gongylosoma) elegans*, Pfr.**

Habana, Cuba. Mr. Arango to Mr. Thomas Bland.

Lingual membrane (pl. XX., fig. 6) with 12—1—12 teeth, ar-

ranged as usual in the genus (see ante, p. 222). The base of attachment is shorter and stouter, the outer cusp of the laterals is larger and on a shorter and stouter pedicle than in *Cylindrella scæva*, figured on page 222. There are no distinct marginals, the teeth slightly and gradually changing in size as they pass off laterally, until in the extremes the two cutting points become of almost equal size and the outer one ceases to be on a distinct pedicle; the base of attachment also in the extremes is almost square.

This membrane is of interest, being the first described of the section *Gongylostoma*, whose dentition was unknown to Messrs. Crosse and Fischer.

Cylindrella cyclostoma, Pfr.

Mr. Arango to Mr. Bland. Lomas de Camoa, Cuba.

Jaw as usual in the genus, with over 70 delicate ribs (see ante, p. 222).

Lingual membrane long and narrow, as usual in the genus. Laterals 2, marginals about 8, these and centrals of same type as those figured by Messrs. Fischer and Crosse (*Journal de Conchyliologie*, 2d s., X.), for the group *Cylindrella*, s. s., as in *Cylindrella costata*, pl. IV., fig. 2.

The first marginal, however, surely is of same type as the laterals, though much smaller and somewhat modified in form. It appears like a transition from the one to the other.

Cylindrella (Thaumasia) Humboldtiana, Pfr.

Cuba. Mr. Arango to Mr. Bland.

Lingual membrane long and narrow, as usual in the genus. Teeth 8—1—8 of same type as figured by Messrs. Fischer and Crosse for *C. rosea* (*Journ. de Conch.*, XVIII, 1870, pl. IV. fig. 4).

The species belongs, therefore, to their group *Thaumasia*.

The jaw is as usual in the genus, with about 100 ribs.

EXPLANATION OF THE PLATES.

PLATE XIX.

t. Testicle.

e. Epididymis.

ac. Accessory gland of last.

ov. Ovary.

ovid. Oviduct.

- p.* Prostate.
v. d. Vas deferens.
p. s. Penis sac.
r. Retractor muscle of last.
or. External orifice of genitalia.
g. b. Genital bladder.
v. Vagina.

- Fig. 1. Genitalia of *Partula*.
 Fig. 2. " *H. Sagemon*, Beck.
 Fig. 3. " *H. auricoma*, Fér.
 Fig. 4. Lingual dentition of *Partula amanda*, Pease. The last figure is the extreme marginal in profile.
 Fig. 5. Jaw of *Partula*.
 Fig. 6. " " *Partula gracilis*, Pease.
 Fig. 7. Genitalia of *Partula umbilicata*, Pease.
 Fig. 8. " " *P. virginea*, Pease.
 Fig. 9. " " *P. fusca*, Pease.
 Fig. 10. " " *P. bilineata*, Pease.
 Fig. 11. Jaw of *P. virginea*, Pease.

PLATE XX.

Lingual dentition and jaw of:—

- Fig. 1. *Nanina subcircula*, Mousson.
 Fig. 2, 3. *Stenogyra hasta*, Pfr.
 Fig. 4. *Helix vortex*, Pfr. (See p. 180.)
 Fig. 5. *Helix septemvolva*, Say. (See p. 203.)
 Fig. 6. *Cylindrella elegans*, Pfr.
 Fig. 7. *Succinea Stretchiana*, Bland. (See p. 232.)
 Fig. 8. *Helix pyrozoona*, Phil.
 Fig. 9. *Macroceramus turricula*, Pfr.
 Fig. 10. *Holospira Goldfussi*, Pfr. (See p. 183.)
 14. The extreme figure is drawn from another portion of the membrane, where the cusps are more highly developed.
 Fig. 11, 12. *Helix astur*, Souv.

PLATE XXI.

Jaw and lingual dentition of:—

- Fig. 1, 2. *Helix Arangiana*, Poey.
 Fig. 3. *Macrocyclus euspira*, Pfr.

Fig. 4. *Helix* Sagemon, Beck.

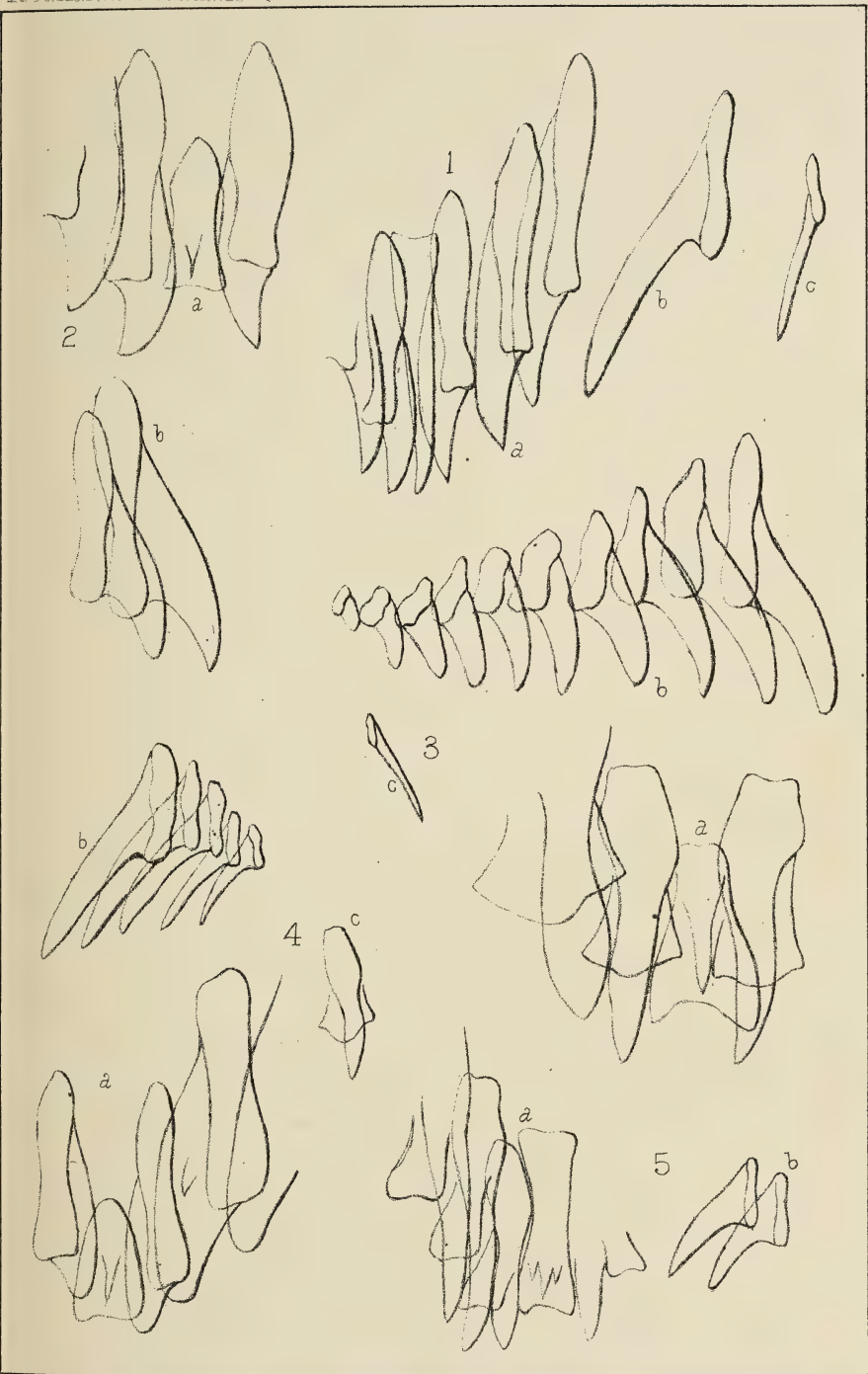
Fig. 5. *Helix* auricoma, Fér.

Fig. 6. *Endodonta* tumuloides, Garrett.

Fig. 7. *Helix* convicta, Cox.

Fig. 8. *Helix* Sieboldtiana, Pfr.

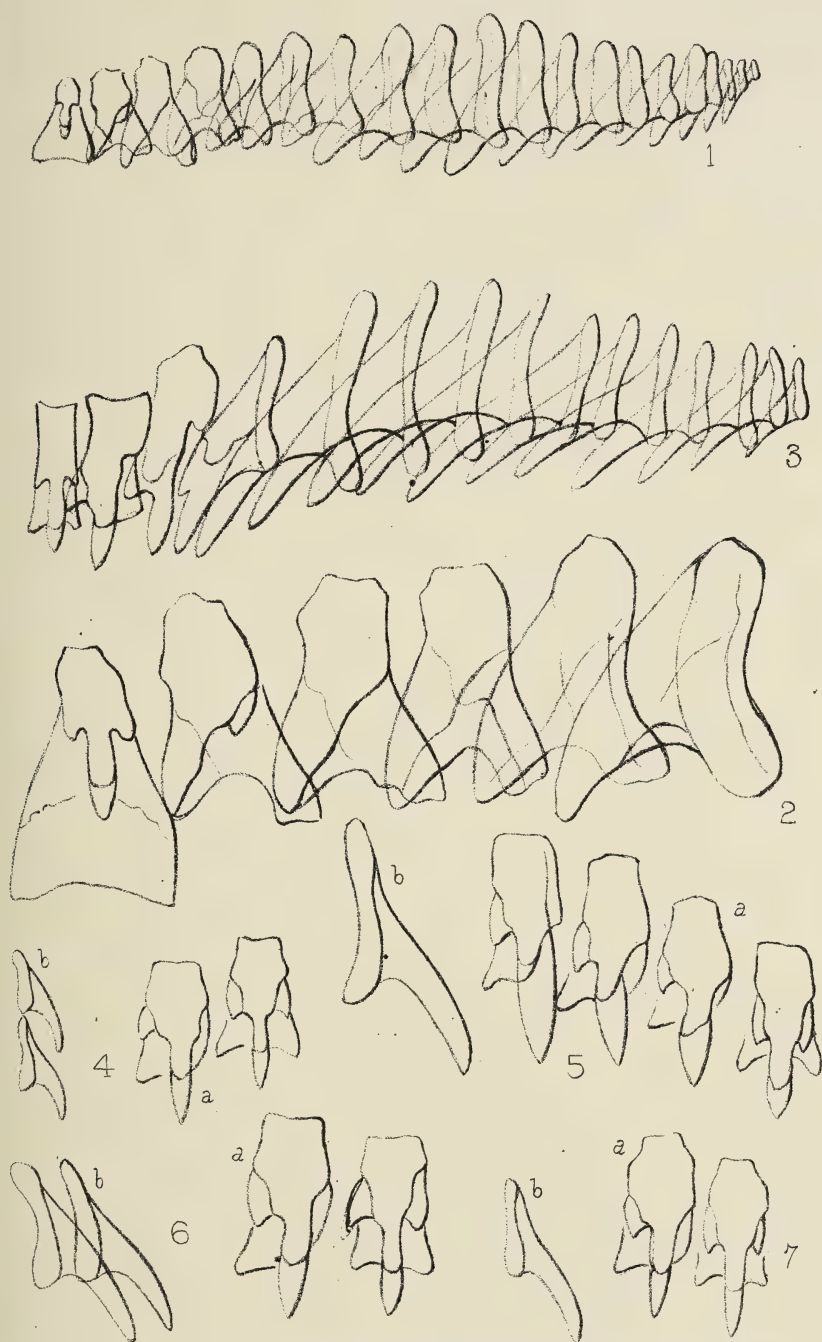
Fig. 9. *Zonites* minusculus, Binney. (See p. 166.)



W.B.B. del.

J.H. Buff. et al. Sculp. Fish. Porton.

1. *Glandina truncata*, Say. 3. *M. concava*, Say.
 2. *Macrocyclus Duranti*, Newc. 4. *M. Vancouverensis*, Lea
 5. *M. Voyana*, Newc.

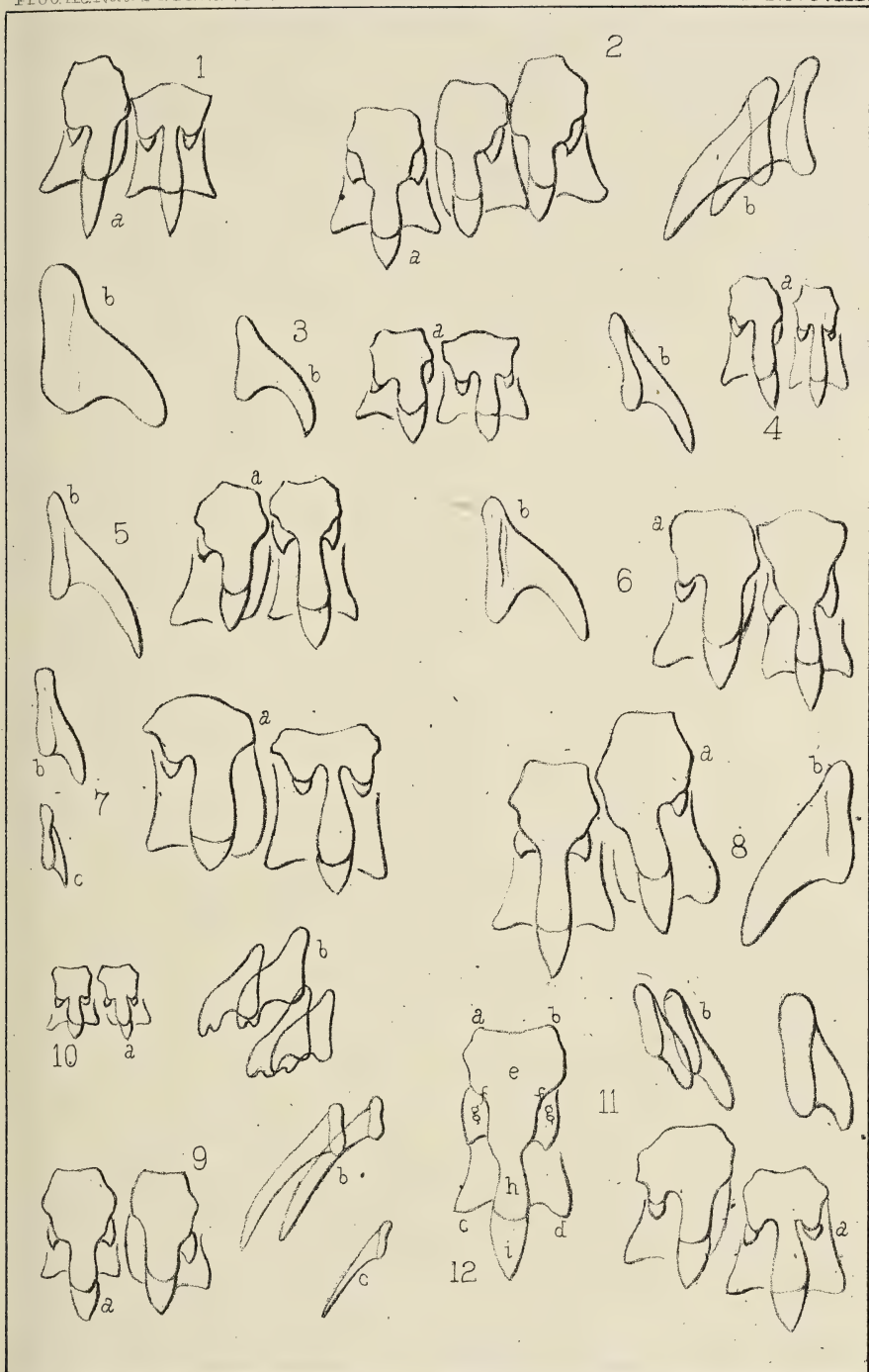


W.G.B. del.

J.H. Faffinda Sons Lith. Boston.

12. *Zonites laevigatus*, Pfr.
 3 *Z. cellarius*, Müll.
 4 *Z. friabilis*, W.G.B.

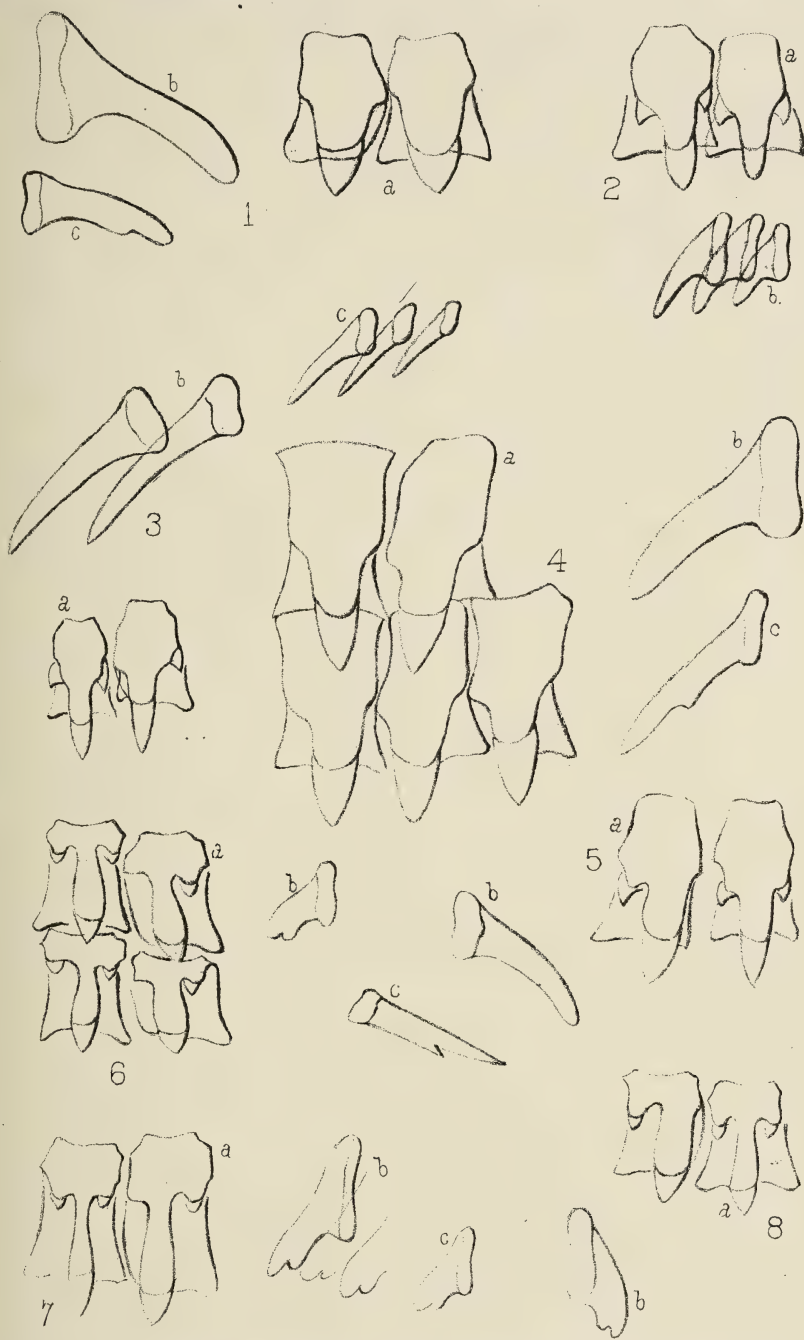
5. *Z. inornatus*, Say
 6 *Z. capnodes*, W.G.B.
 7. *Z. fuliginosus*, Grif.



W.G.B. del.

J.H. Bufford & Sons Lith Boston.

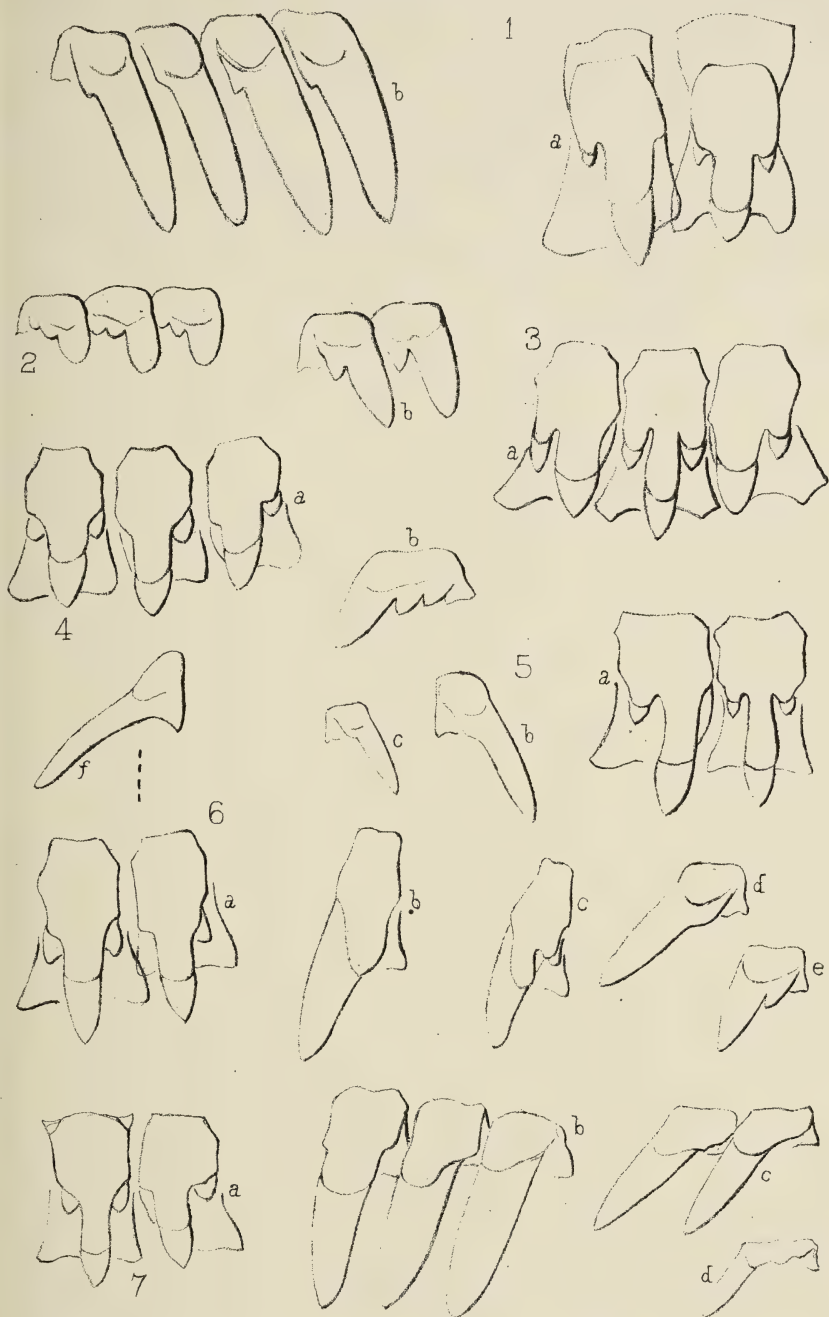
- | | | |
|------------------------------|-------------------------------|---------------------------------|
| 1. <i>Z. gularis</i> S. | 5. <i>Z. Elliotti</i> , Red. | 9. <i>Z. internus</i> S. |
| 2. <i>Z. sculptilis</i> Bl. | 6. <i>Z. demissus</i> , B. | 10. <i>Z. Gundlachii</i> , Pfr. |
| 3. <i>Z. imatulus</i> Ward. | 7. <i>Z. lasmodor</i> , P. | 11. <i>Z. ligerus</i> S. |
| 4. <i>Z. capsella</i> , Gld. | 8. <i>Z. intertextus</i> , S. | 12. <i>Z. capnodes</i> , WGB. |



W.G.B. del.

J.H. Buffords Sons Lith. Boston

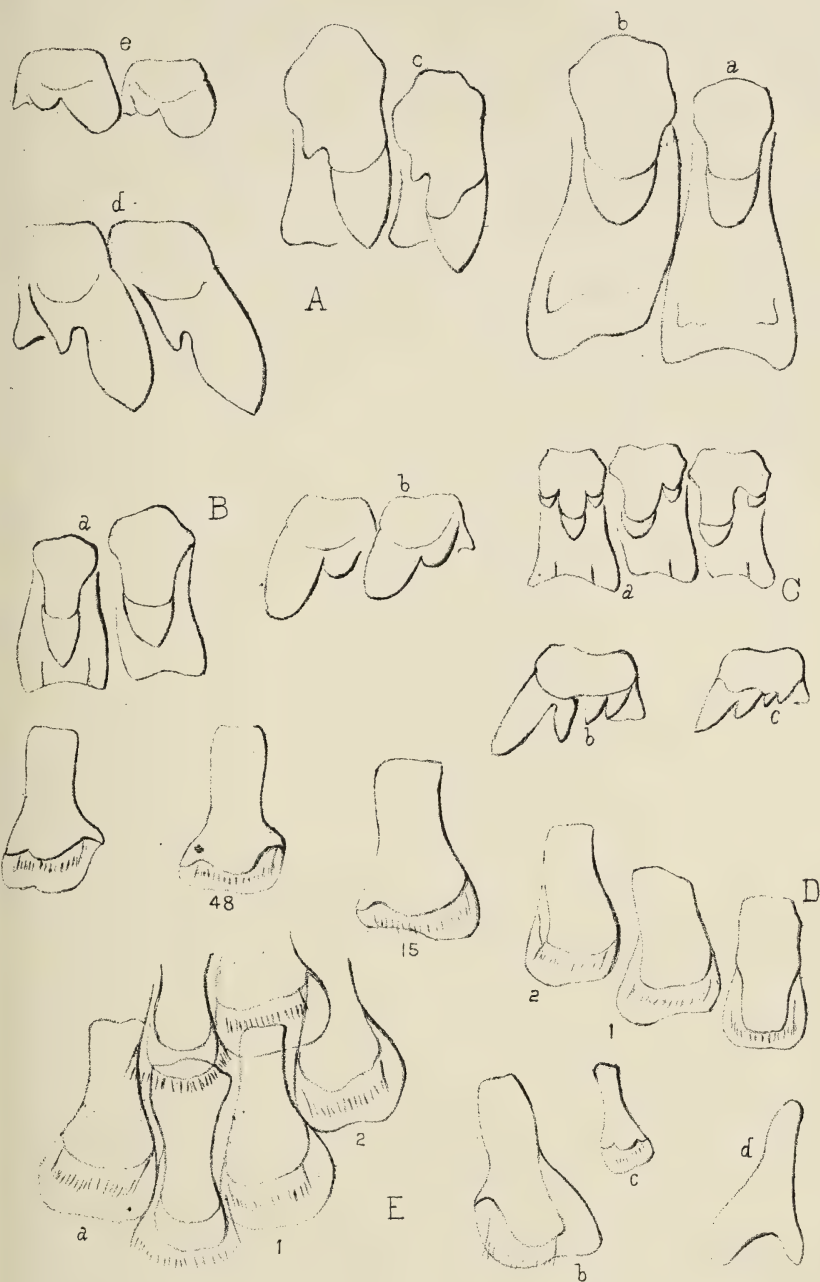
1. *Limax flavus*, Lin.2. *L. Hewstoni*, J.G.C.3. *L. agrestis*, Lin.4. *L. maximus*, Lin.5. *L. campestris*, Binn.6. *Vitrina Pfeifferi*, Newc.7. *V. vexilis*, Mar.8. *V. limpida*, Gld.



W.G.B.del.

J.H. Buffords Sons Lith. Boston.

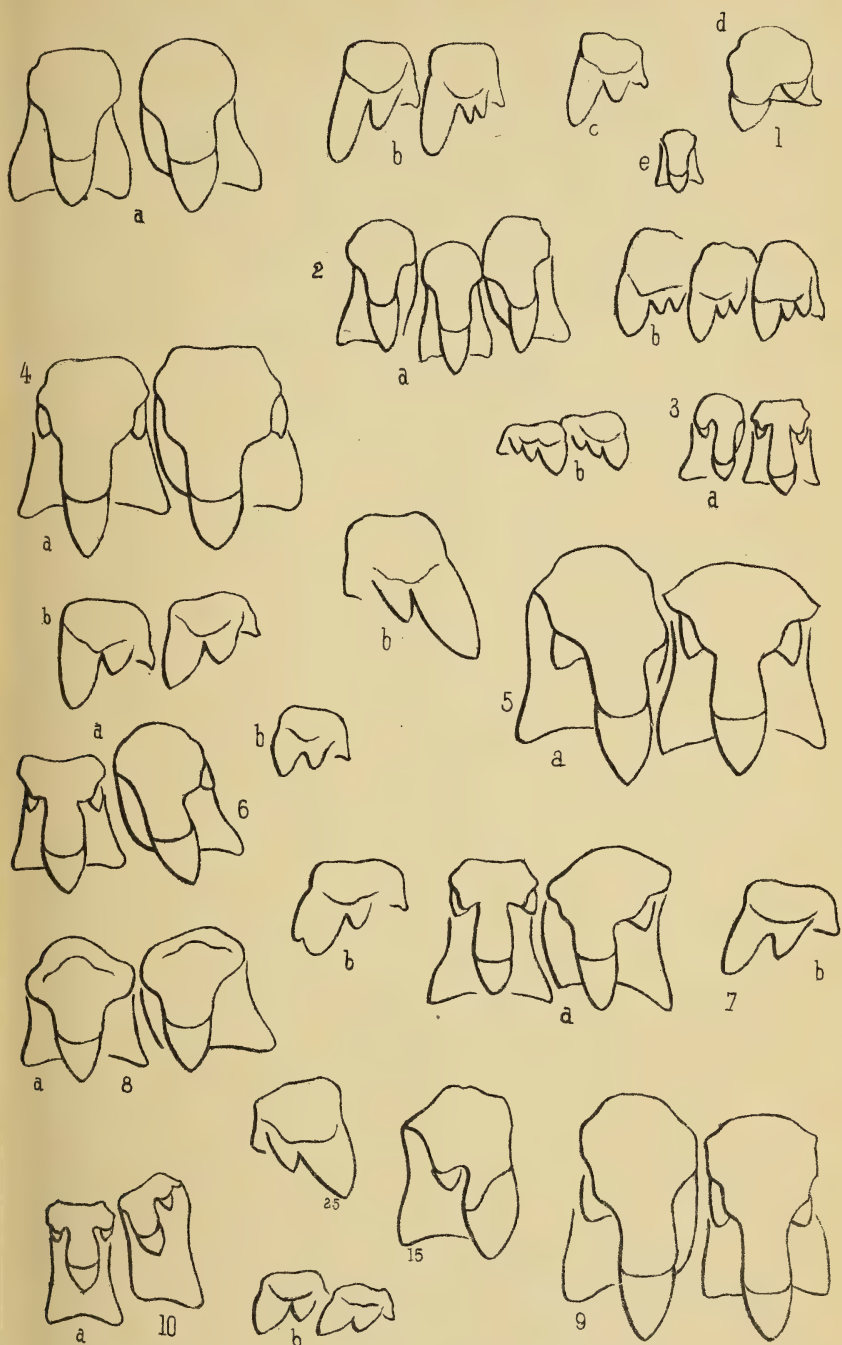
1. *Ariolimax Californicus*, J.G. Coop. 5. *Arion hortensis*, Fér.
 2, 3. *A. niger*, J.G. Coop. 6. *Ariolimax Columbianus*, Gld.
 4. *Prophysaon Hemphilli*, Bl. & Binn. 7. *Hemphillia glandulosa*, Bl. & Binn.



W.G.B. del.

J.H. Buffords Sons Lith Boston.

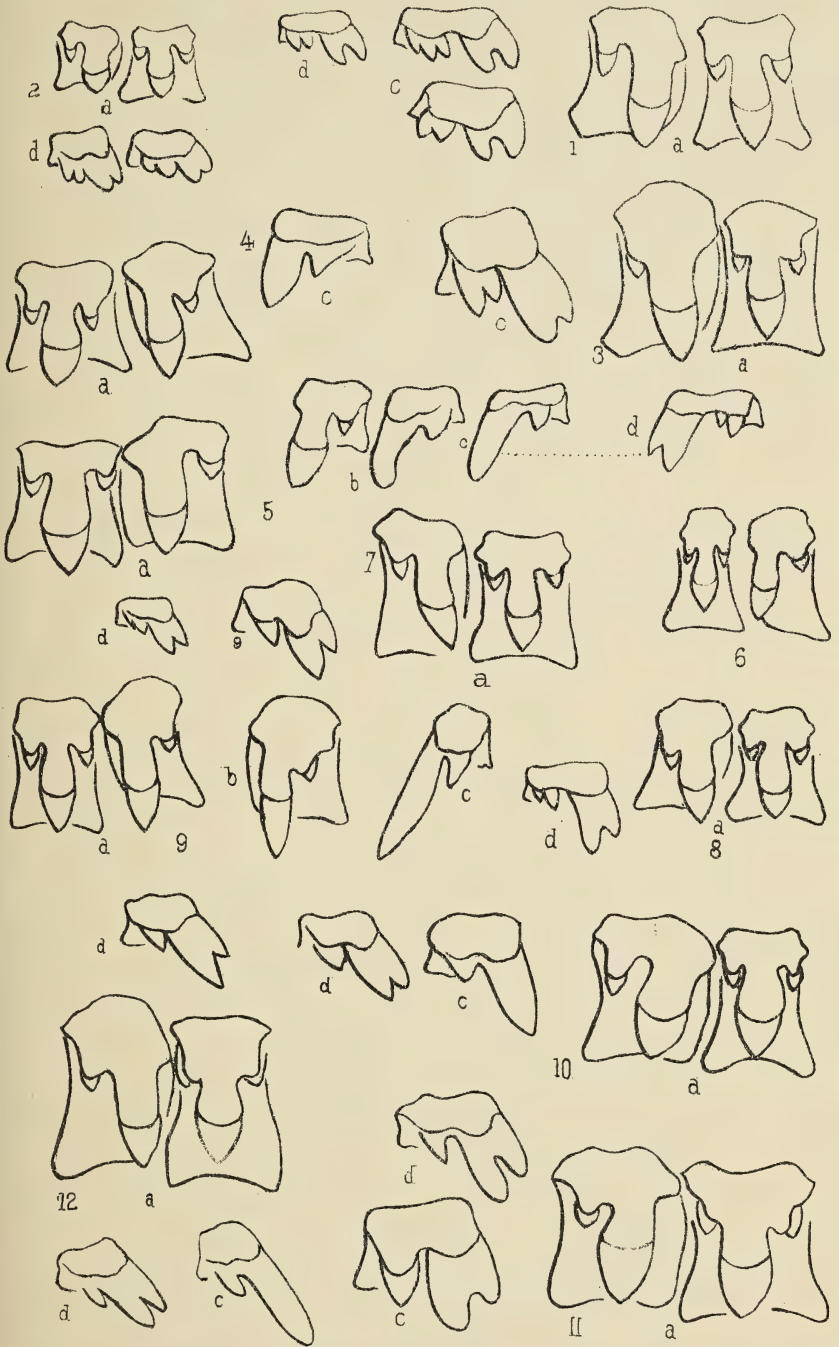
A. *Thermophorus Caroliniensis*, Bosc. C. *Pallifera dorsalis* Binn.
 B. *Pallifera Wetherbyi*, W.G.B. D. *Orthalicus undatus*, Brug.
 E. *Liguus fasciatus*, Mull.



W. G. B. del.

T. Sinclair & Son, lith. Phila.

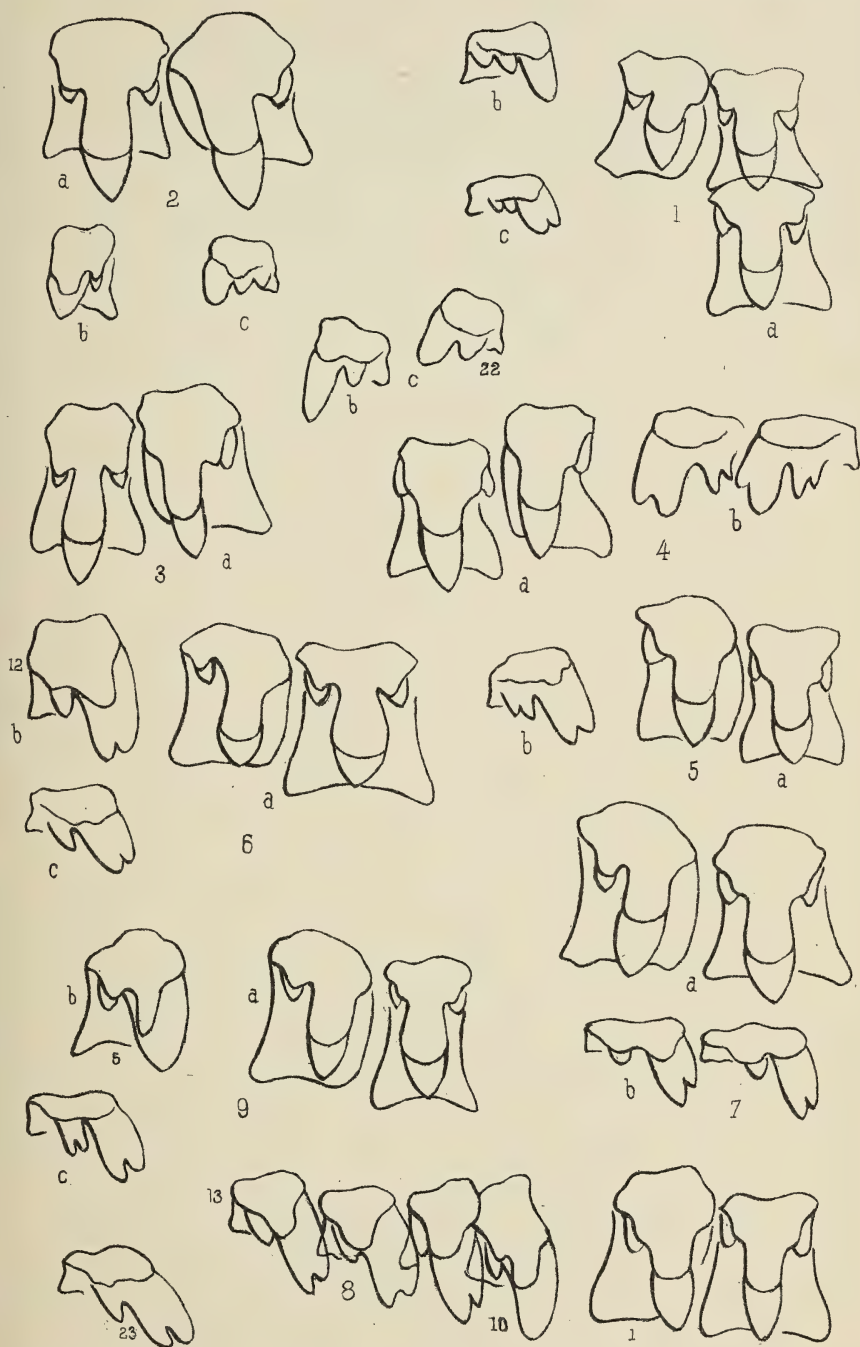
1. *Patula strigosa*, *Gld.* 4. *Patula Idahoensis*, *Newc.* 8. *Patula Cumberlandiana*, *Lea.*
 2. *Patula Cooperi*, *W.G.B.* 5. *Patula alternata*, *Say.* 9. *Patula solitaria*, *Say.*
 3. *Patula perspectiva*, *Say* 6. *Patula Hemphilli*, *Newc.* 10. *Patula striatella*, *Anth.*
 7. *Patula mordax*, *Shuttl.*



W. G. B. del.

T. Sinclair & Son, lith. Phila.

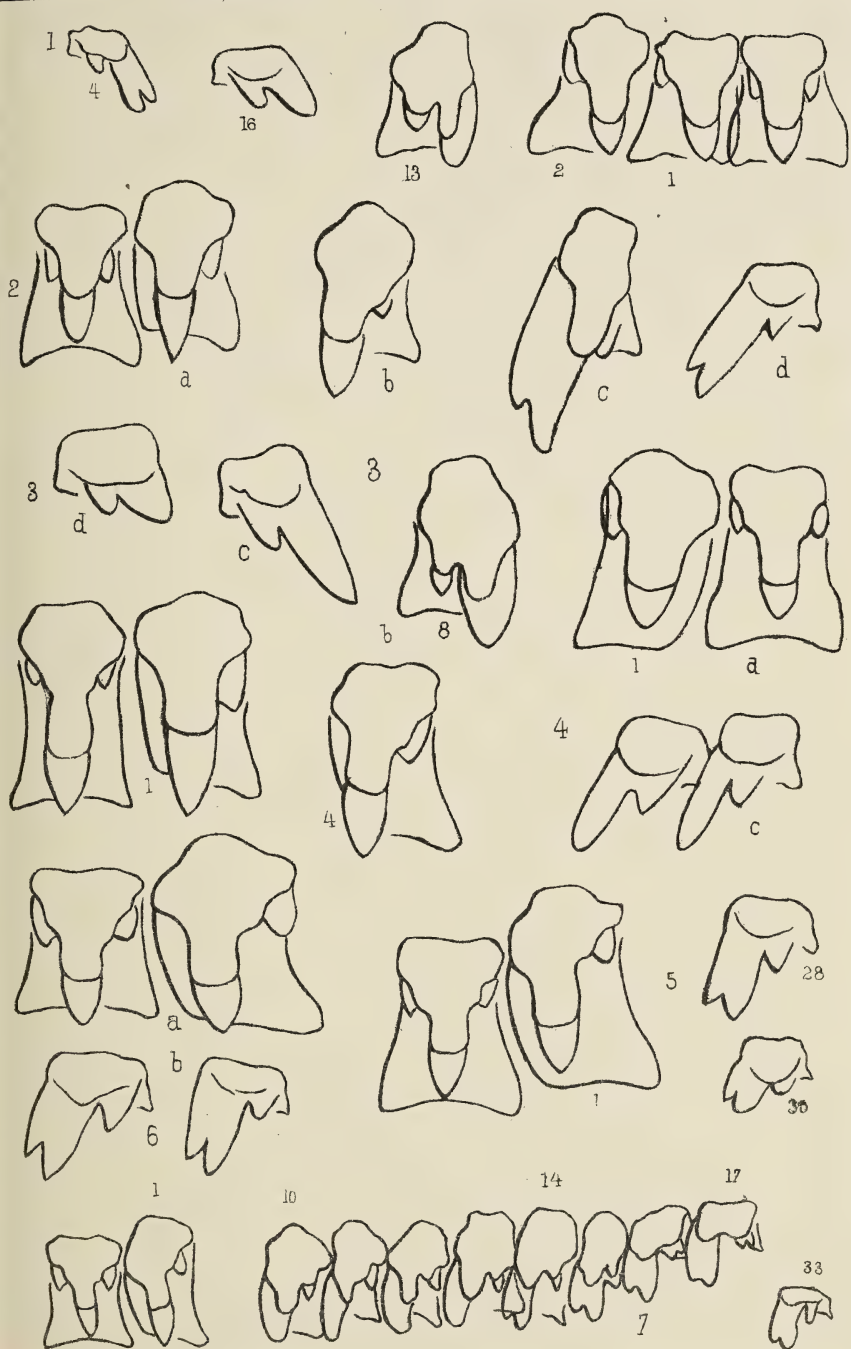
1. *Helix Texasiana*, Mor. 5. *Helix Hazardi*, Bl. 9. *Helix auriformis*, Bl.
2. *Helix Troostiana*, Lea. 6. *Helix Septemvolva*, Say. 10. *Helix Mooreana*, W. G. B.
3. *Helix uvulifera*, Shutt. 7. *Helix Febigeri*, Bl. 11. *Helix fastigans*, Say.
4. *Helix espiloca*, Rav. 8. *Helix pustula*, Fer. 12. *Helix auriculata*, Say.



W. G. B. del.

T. Sinclair & Son, lith. Phila

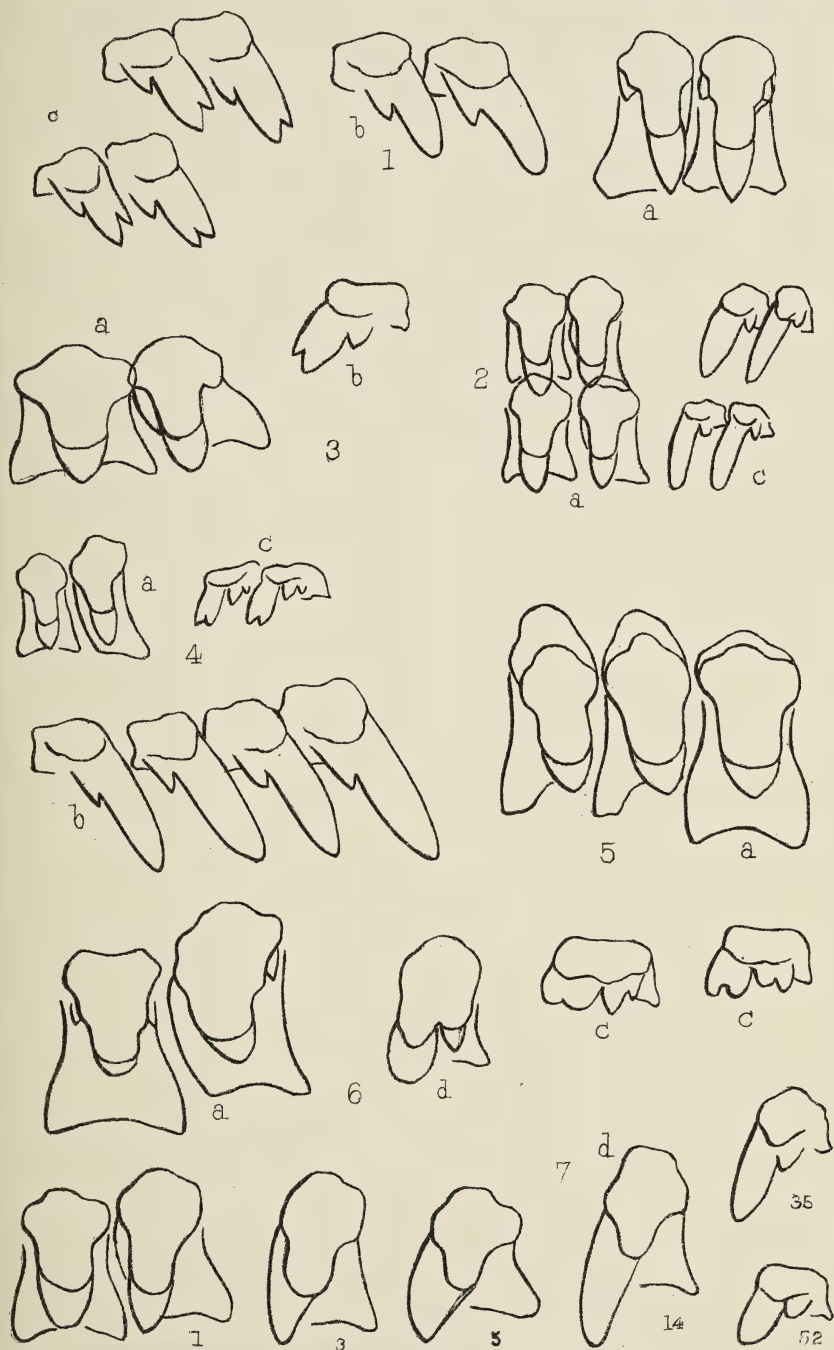
1. *Helix Edvardsi*, Bland. 4. *Helix monodon*, Rack. 7. *Helix stenotrema*, Fér.
 2. *Helix polygyrella*, Bland. 5. *Helix germana*, Gld. 8. *Helix spinosa*, Lea.
 3. *Helix Yatesi*, J. G. Coop. 6. *Helix hirsuta*, Say. 9. *Helix barbigera*, Redf.



W. G. B. del.

T. Sinclair & Son, lith. Phila.

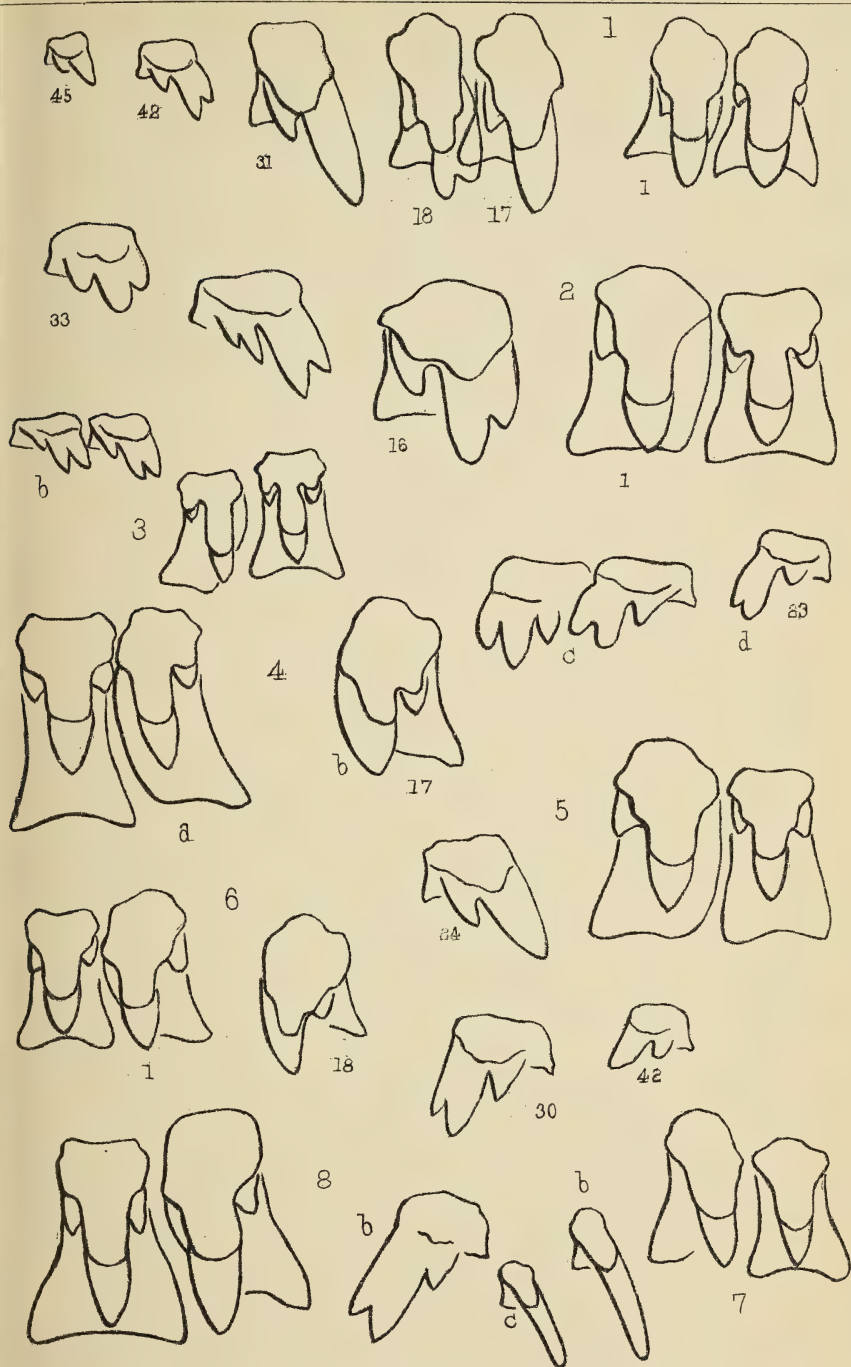
1. *Helix tridentata*, Say. 3. *Helix Rugeli*, Shuttl. 6. *Helix Hopetonensis*, Shuttl.
 2. *Helix palliata*, Say. 4. *Helix inflecta*, Say. 7. *Helix appressa*, Say.
 5. *Helix fallax*, Say.



W. G. B. del.

T. Sinclair & Son. lith. Phila

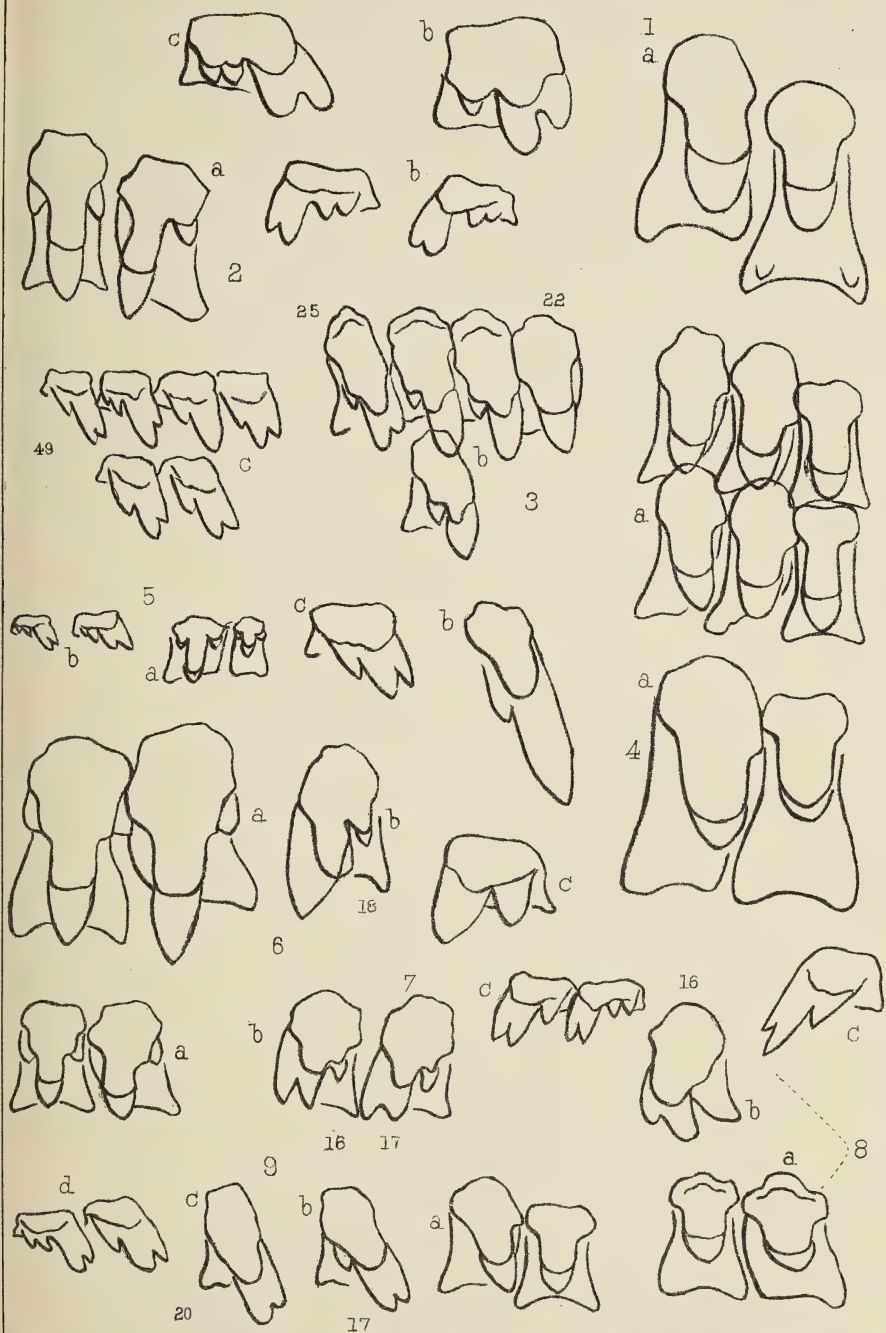
1. *Helix albolabris*, Say. 3. *Helix Roemeri*, Pfe. 6. *Helix Clarki*, Lea.
 2. *Helix Wetherbyi*, Blnd. 4. *Helix Downieana*, Bl. 7. *Helix exoleta*, Binn.
 5. *Helix Sayii*, Binn.



W. G. B. del.

T. Sinclair & Son. lith. Phila.

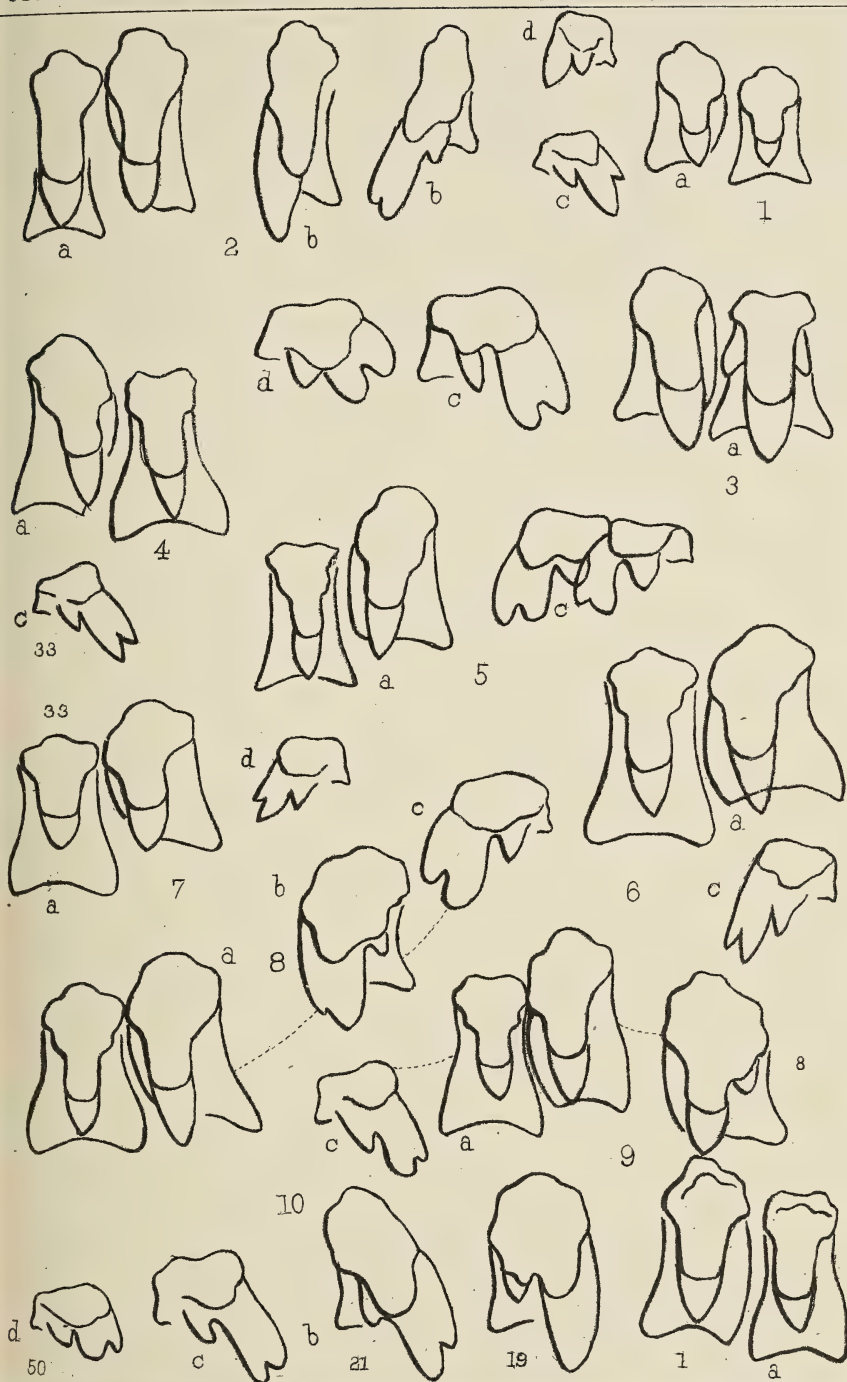
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|-----------------------------------|-------------------------------------|
| 1. <i>Helix elevata</i> , Say. | 5. <i>Helix profunda</i> , Say. |
| 2. <i>Helix Columbiana</i> , Lea. | 6. <i>Helix multilineata</i> , Say. |
| 3. <i>Helix Mobiliana</i> , Lea. | 7. <i>Helix clausa</i> , Say. |
| 4. <i>Helix devia</i> , Glä. | 8. <i>Helix dentiifera</i> , Binn. |



W. G. B. del.

T. Sinclair & Son, lith. Phila.

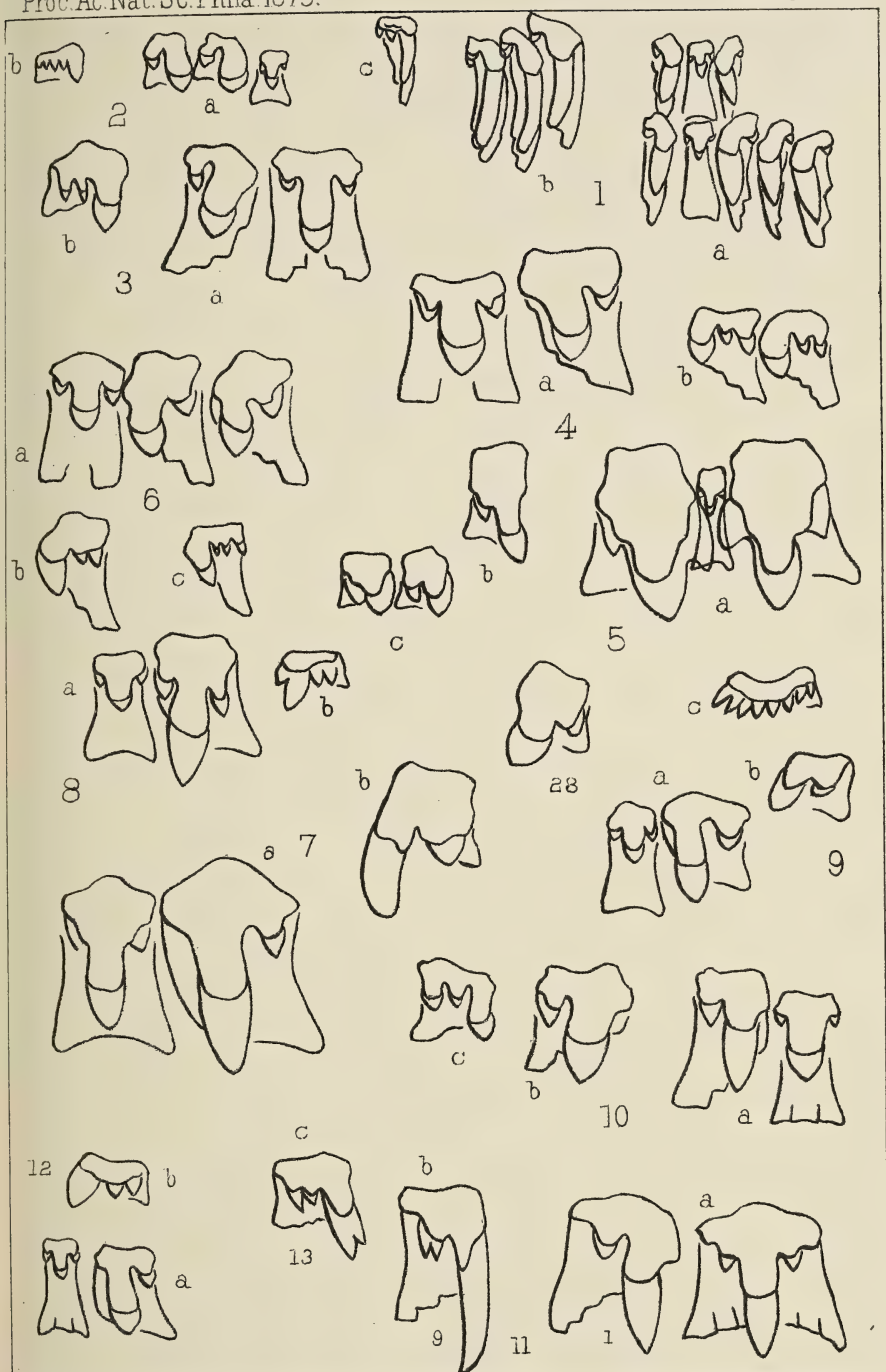
1. *Hemitrochus varians*, Mke. 5. *Helix lineata*, Say.
2. *Helix griseola*, Pfr. 6. *Helix Newberryana*, W. G. Binn.
3. *Helix Stearnsiana*, Gabb. 7. *Helix aspersa*, Müll.
4. *Helix Kelletti*, Forb. 8. *Helix fidelis*, Gray.
9. *Helix infumata*, Gld.



W. G. B. del.

T. Sinclair & Son, lith. Phila.

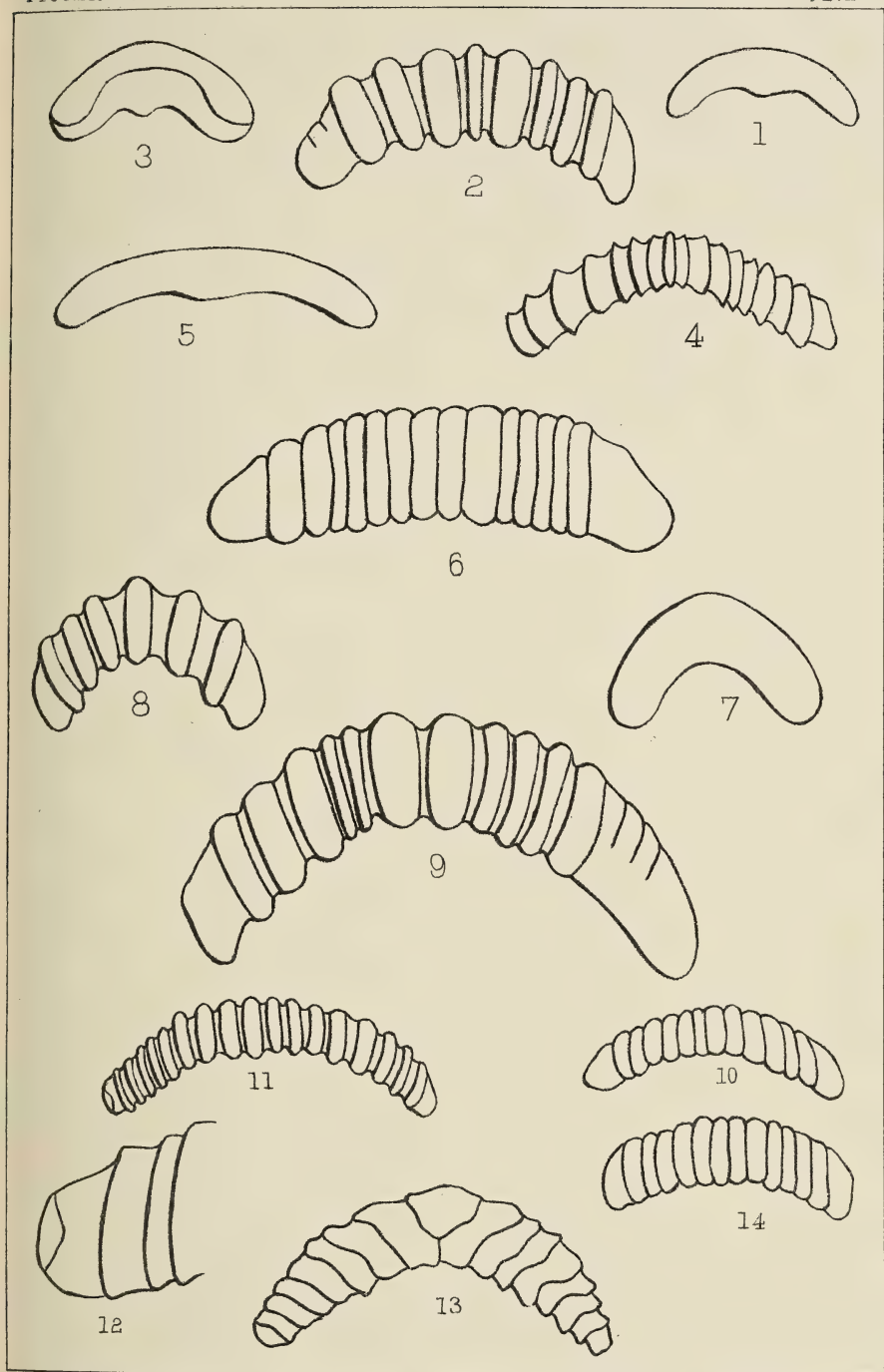
1. *Helix tudiculata*, *Binn.* 4. *Helix Traski*, *Newc.* 8. *Helix Nickliniana*, *Lea.*
 2. *Helix arrosa*, *Binn.* 5. *Helix sequoicola*, *J. G. Cooper* 9. *Helix ramentosa*, *Gld.*
 3. *Helix ruficincta*, *Newc.* 6. *Helix Ayresiana*, *Newc.* 10. *Helix exarata*, *Pfr.*
 7. *Helix redimita*



W. G. B. del.

T. Sinclair & Son, lith. Phila

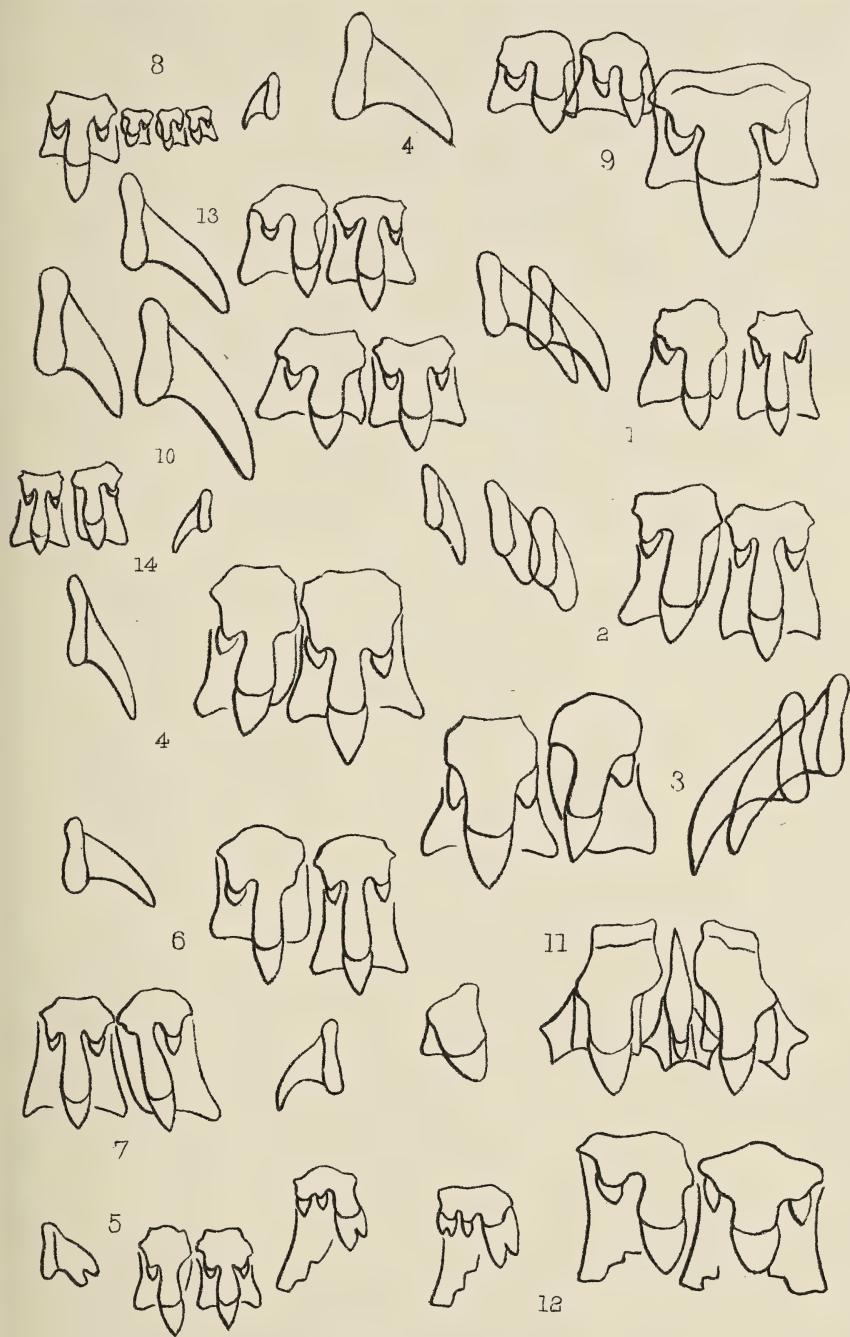
- | | | |
|-------------------------------------|------------------------------------|---|
| 1. <i>Macroceramus Gossei</i> , Pf. | 5. <i>Stenogyra decollata</i> , L. | 9. <i>Cecilianella subcylindrica</i> , Lir. |
| 2. <i>Pupa rupicola</i> , Say. | 6. <i>Succinea effusa</i> , Shutt. | 10. <i>Succinea campestris</i> , Say. |
| 3. <i>Succinea avara</i> , Say. | 7. <i>Bulinus dealbatus</i> , Say. | 11. <i>Succinea lineata</i> , W. G. B. |
| 4. <i>Succinea obliqua</i> , Say. | 8. <i>Stenogyra subula</i> , Pf. | 12. <i>Pupa fallax</i> , Say. |



W. G. B. del.

T. Sinclair & Son, lith. Phila.

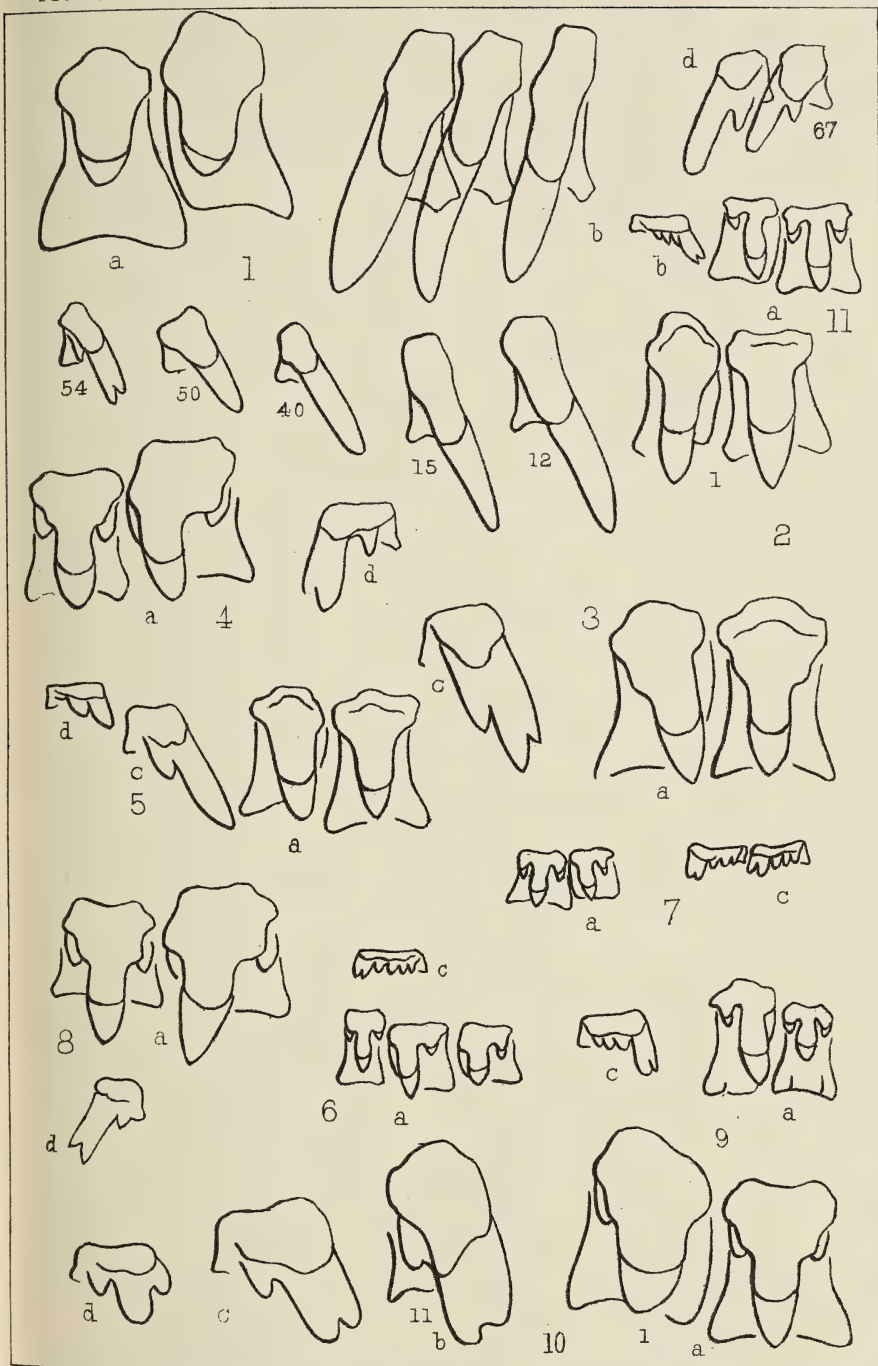
- | | | |
|---|-----------------------------------|--|
| 1. <i>Stenogyra subula</i> , Pfr. | 6. <i>Hemphillia glandulosa</i> , | 10. <i>Helix Yatesi</i> , J. G. Coop. |
| 2. <i>Arion hortensis</i> , Fer. | 7. <i>Pupa rupicola</i> , Say. | 11. <i>Helix polygyrella</i> , Bl. & J. G. Coop. |
| 3. <i>Vitrina limpida</i> , Gld. | 8. <i>Helix aspersa</i> , Mill. | 12. <i>Bulimulus sufflatus</i> , Gld. |
| 4. <i>Helix Newberryana</i> , W. G. B. | 9. <i>Prophysaon Hemphilli</i> , | 13. <i>Orthalicus undatus</i> , Brug. |
| 5. <i>Ferussacia subcylindrica</i> , C. | Bl. & Binn. | 14. <i>Helix griseola</i> , Pfr. |



W. G. B. del

T. Sinclair & Son, lith. & ma.

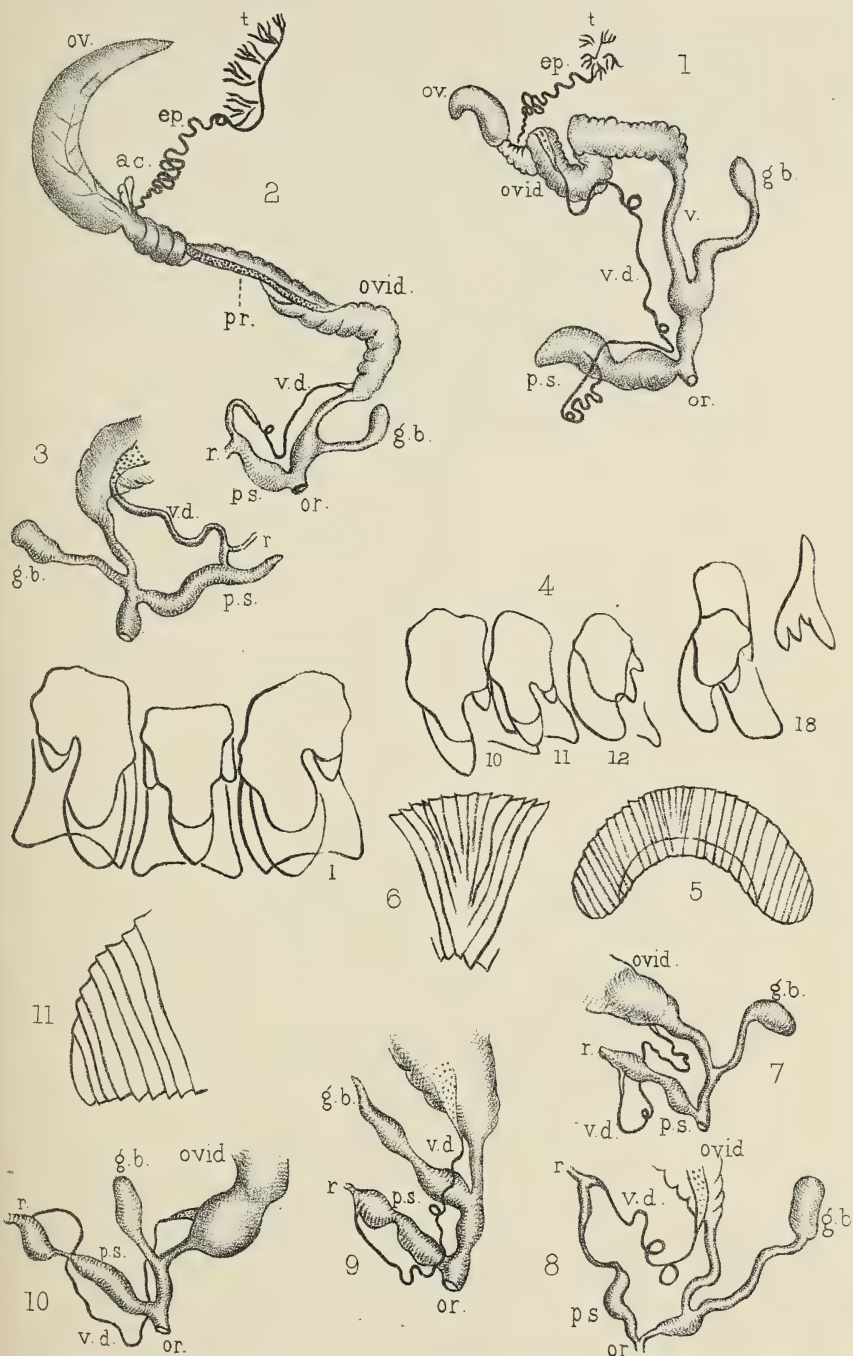
- | | | |
|--|--|---|
| 1. <i>Zonites multidentatus</i> , <i>Binn.</i> | 6. <i>Zonites viridulus</i> , <i>Misc.</i> | 11. <i>Veronicella Floridana</i> , <i>Binn.</i> |
| 2. <i>Zonites suppressus</i> , <i>Say.</i> | 7. <i>Zonites nitidus</i> , <i>Mill.</i> | 12. <i>Succinea Sillimani</i> , <i>Bland.</i> |
| 3. <i>Zonites indentatus</i> , <i>Say.</i> | 8. <i>Zonites milium</i> , <i>Morse.</i> | 13. <i>Zonites Binneyanus</i> , <i>Morse.</i> |
| 4. <i>Zonites arboreus</i> , <i>Say.</i> | 9. <i>Zonites ferreus</i> , <i>Morse.</i> | 14. <i>Zonites exiguus</i> , <i>St.</i> |
| 5. <i>Zonites fulvus</i> , <i>Drap.</i> | 10. <i>Zonites significans</i> , <i>Bland.</i> | |



W.G.B. del.

T. Sinclair & Son. lith. Phila.

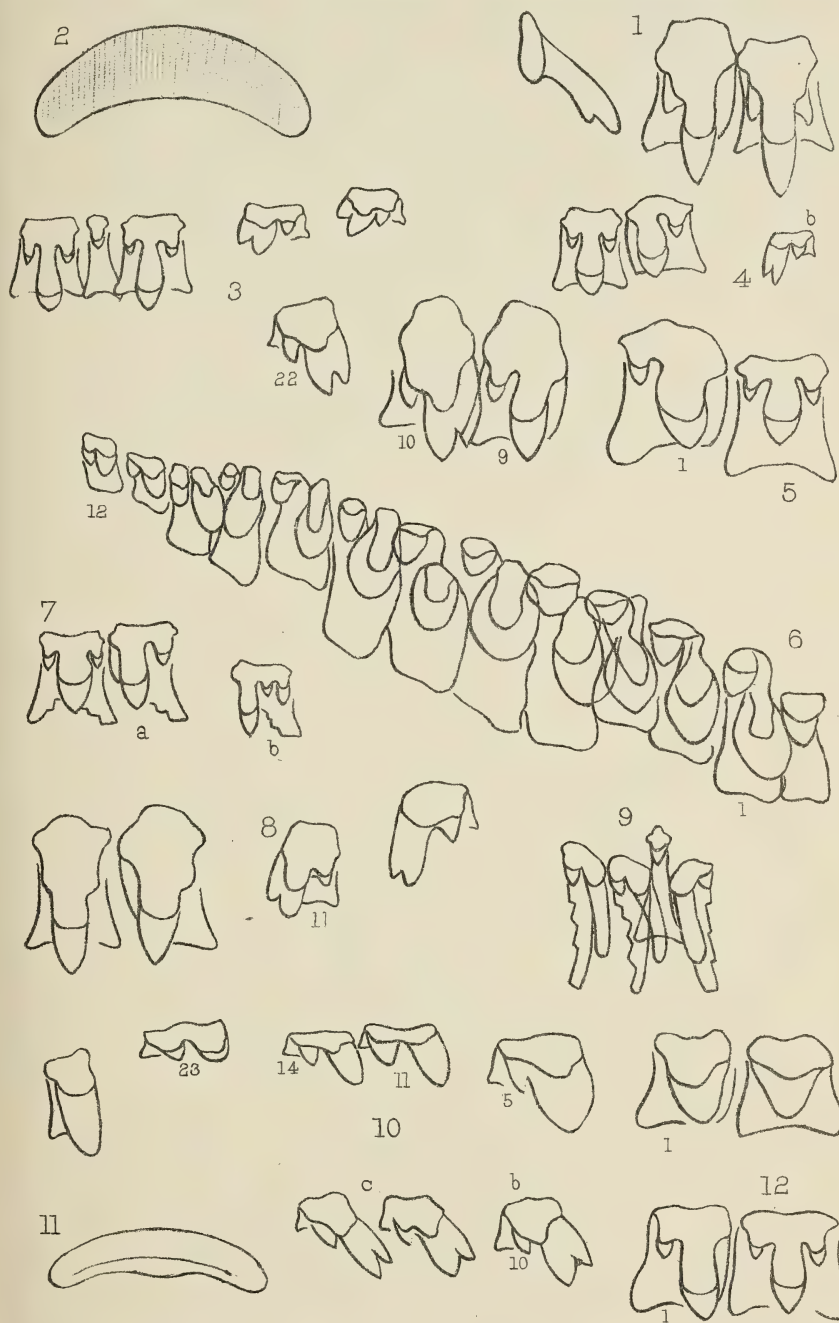
- | | | |
|--|-------------------------------------|-------------------------------------|
| 1. <i>Helix Wheatleyi</i> , Bland. | 5. <i>Helix Mitchelliana</i> , Lea. | 9. <i>Helix asteriscus</i> , Morse. |
| 2. <i>Helix thyroides</i> , Say. | 6. <i>Helix pulchella</i> , Müll. | 10. <i>Helix obstricta</i> , Lea. |
| 3. <i>Helix Pennsylvanica</i> , Green. | 7. <i>Helix labyrinthica</i> , Say. | 11. <i>Helix Hubbardi</i> , A.D.Br. |
| 4. <i>Helix loricata</i> , Glä. | 8. <i>Helix Townsendiana</i> , Lea. | |



W. G. B. del.

T. Sinclair & Son, lith. Phila.

1. *Partula*. 5. *Partula*. 9. *P. fusca*, *Pse.*
 2. *H. sagemon*, *Blt.* 6. *P. gracilis*, *Pse.* 10. *P. bilineata*, *Pse.*
 3. *H. auricoma*, *Fer.* 7. *P. umbilicata*, *Pse.* 11. *P. virginea*, *Pse.*
 4. *P. amanda*, *Pse.* 8. *P. virginea*, *Pse.*



W. G. B. del.

T. Sinclair & Son. lith. Phila.

1. *N. subcircula* M. 5. *H. septemvolva*, S. 9. *Macr. turricula*, Pfr.
 2-3. *Sten. hasta*, Pfr. 6. *C. elegans*, Pfr. 10. *H. Goldfussi*, M'ce.
 4. *Helix vortex*, Pfr. 7. *S. Stretchiana*, Bl. 11 12. *H. astur*, Sb.
 8. *H. pyrozoona*, Pl.



W. G. B. del.

T. Sinclair & Son. lith. Phila.

- 1-2. *H. Arangiana*, *Pr.* 5. *H. auricoma*, *Fer.* 8. *H. Sieboldtiana*, *Pfr.*
 3. *Macrocephala*, *Pfr.* 6. *End. tumuloides*, *Garr.* 9. *Z. minusculus*, *Burr.*
 4. *H. sagemon*, *Bk.* 7. *H. convicta*, *Cor.*





*Dr. Cassin -
with compliments of A. F. Gray*

N O T E S

ON

AMERICAN LAND SHELLS

AND OTHER

MISCELLANEOUS CONCHOLOGICAL CONTRIBUTIONS.

VOL. II. PART IV.

BY

W. G. BINNEY.



BURLINGTON, N. J.

PRINTED FOR THE AUTHOR.

AUGUST, 1875.

[Reprinted from the *Annals of the Lyceum of Natural History*, N. Y., Vol. xi,
November, 1875.]

XX. *On the Genitalia, Jaw and Lingual Dentition of certain species of Pulmonata.*

By W. G. BINNEY.

[With a Note on the Classification of the Achatinellæ, by Thomas Bland.]

Read October 11, 1875.

IN the following pages I have not considered it necessary to offer a full description of the dentition in cases where a figure is given. In the Proceedings of the Academy of

Natural Sciences of Philadelphia, 1875, p. 145, full explanation will be found of the terms I use. In the plates, I have endeavored to give a perfect idea of the several forms of teeth on each lingual membrane by figuring the central with the first lateral tooth, the transition from lateral to marginal teeth, and a decided marginal, usually the last. The position of each tooth from the median line is indicated on the plates by numerals. The plates must, however, be studied with the text. It will be seen that the cutting points of the teeth are shaded. I have not, also, considered it necessary fully to describe the genitalia in cases where I have given a figure of the system. I have rather confined myself to pointing out the characteristic feature of each. In the lettering of the plates, I have not deemed it important to indicate the testicle, epididymis, accessory gland, prostate, vas deferens, ovary or oviduct, as those organs cannot fail to be recognized. I have, however, indicated the penis sac, retractor of same, genital bladder with its duct, and any accessory organs that may occur. As in my former publications, I apply the terms ovary and testicle as does Dr. Leidy in the first volume of "Terrestrial Mollusks of the United States."

Glandina truncata, Say.

On plate xiv, fig. F, I have given a figure of the central tooth of this species which is more accurate than that given in Proc. Phila. A. N. S., 1875, pl. i, fig. 1. It will be seen to agree with the figure of Morse (Ib. p. 156, fig. 2) as regards the presence of a distinct cusp. The figure was drawn from the lingual membrane of a large Florida specimen.

It will be of interest to note here that the largest specimens of *Glandina* found by me near St. Augustine, were in the centre of the clumps of large, coarse grass covering the marshes at the edge of Matansas River. Mr. Say also speaks of finding the largest specimens in the marshes immediately behind the sand hills of the coast.

***Nanina radians*, Pfr. (*Microcystis*).**

Rarotonga Isl., Mr. A. Garrett.

Plate xvi, fig. 1, represents one central, lateral and marginal tooth. There are 40-1-40 teeth, 8 being perfectly formed laterals. The marginals are sometimes trifid.

For the identification of this and of the following Society Island species I am indebted to Mr. Garrett. They form a part of an extremely interesting collection of Society Island land shells, preserved in spirits, just received from him, through Dr. W. D. Hartman of West Chester, Pa.

***Nanina conula*, Pease.**

Island of Huahine, Mr. A. Garrett.

Central and lateral teeth as in *N. radians*, Pfr. (see above). Lateral teeth seven in number. Marginals aculeate, multifid, very numerous.

The species is viviparous.

***Nanina calculosa*, Gould.**

Island of Huahine, Mr. A. Garrett.

Jaw as usual in the genus. Lingual membrane long and narrow. Teeth 38-1-38. Centrals and (7) laterals as in *N. radians* (see above), the latter, however, have slightly developed, inner, side cutting points. First 15 marginals bifid, the balance multifid.

The species is viviparous.

***Trochomorpha Cressida*, Gould.**

Island of Huahine, Mr. A. Garrett.

Jaw arched, high; ends blunt; cutting margin with a median beak-like projection.

Lingual membrane (pl. xvi, fig. H.) with 55-1-55 teeth. The bifurcation of the cutting point of the marginals commences in the 11th tooth. There are no side cusps to centrals and laterals, which have a long, narrow base of attachment.

I figure one central, one lateral and one marginal tooth.

Von Martens puts the species in *Discus*, a subgenus of *Nanina*.

Zonites cerinoideus, Anthony.

• Charleston, S. C., Mr. W. G. Mazyck.

The animal has the distinct locomotive disk and the parallel furrows above the margin of the foot, meeting above a distinct, caudal mucus pore, characteristic of the genus. It has also a dart and sac, as in *Z. ligerus*.

Jaw as usual in the genus. Lingual membrane (pl. xiii, fig. B), as usual in the genus. (See Proc. Phila. Ac. Nat. Sc., 1875, 161). Teeth 34-1-34 with 9 perfect laterals.

Limax montanus, Ingersoll.

(Report on Nat Hist. of U. S. Geolog. and Geogr. Survey of the Territories, 1874, p. 130.)

This species was found by Mr. Ernest Ingersoll, in the mountains of Colorado, at "camps 9-11, Blue River Valley," while attached to the Survey of the Territories, in 1874.

The animal is about 18-25 mill. long. It presents no peculiar external characters. Its color is brown, with mantle, head, tentacles and eyeduncles black: bottom of foot white. On opening the animal I found it does not agree in dentition with *L. campestris*, the only native species whose presence could be expected there.

The jaw is as usual in the genus. The lingual membrane is long and narrow. Teeth 50-1-50 (pl. xviii, fig. D), arranged as usual in the genus *Limax*. The central teeth have decided side cusps and cutting points. The lateral teeth are like the centrals, but unsymmetrical and consequently bicuspid; there are about 16 perfect laterals. The marginals are purely aculeate in form, are arranged as usual in the genus (see Proc. A. N. S. Phila., 1875, 172), and all have a slightly developed side spur, making the tooth bicuspid.

L. campestris has no side spur to its inner marginals, though it has such on the outer ones. Otherwise the dentition is about the same.

In its genitalia also, this species is nearly allied to *L. campestris*, as will be seen in comparing my figure (pl. xii, fig. 4), with that of Dr. Leidy (Terr. Moll. U. S. pl. ii, fig. 6). *Limax Ingersolli*, however, differs in the shape of its genital bladder and the shortness of the duct.

With *Limax montanus* were specimens whose dentition (pl. xviii, fig. F), differs only in having a less number of teeth, 34-1-34, with 12 perfect laterals. The teeth are of the same type as in *L. montanus*. The animal is shorter, by about one-half. This form has been noticed as *L. castaneus* by Mr. Ingersoll, l. c. p. 131.

In dentition and genitalia *L. montanus* differs from all the other species, native and introduced, thus far known to exist in North America.

Patula Cumberlandiana, Lea.

Sewanee, Tenn. Dr. Jno. B. Elliott.

Jaw of the same type as in *P. alternata* (see Proc. Ac. Nat. Sc. Phila., 1875, 177, fig. 21). There are coarse vertical striæ.

Lingual membrane (pl. xv, fig. E) long and narrow. Teeth of same type as in *P. solitaria*, *alternata*, etc. (see same reference, 178). The centrals and laterals have, however, a much shorter median cusp. Side cusps subobsolete, and side cutting points wanting on the centrals and first two laterals, the third lateral beginning to show them; the outer laterals, as the seventh lateral etc. (see plate), have them well developed. The transition to marginals is very gradual and is not formed by the bifurcation of the inner cutting point, which remains simple to the extreme outer edge. The smaller, outer cutting point is sometimes bifid in the outer marginals. These last are usually but a simple modification of the laterals, as shown (see plate) in the 20th and 30th teeth.

There are 30-1-30 teeth, with hardly 13 laterals, and certainly not so many absolutely perfect ones.

In *P. alternata* (see as above, p. 180, pl. vii, fig. 5) there are decided prominent side cusps and cutting points to centrals and first laterals. The shape of the centrals and first laterals also in *alternata*, is quite different from those of this species.

The genitalia agree with those of *P. alternata* figured by Dr. Leidy, in Terr. Moll. U. S., I. pl. vii, fig. 2, excepting, perhaps, that in *Cumberlandiana*, the genital bladder is smaller, and its duct longer and narrower.

For the specimens examined I am indebted to Dr. Elliott, a son of the late Bishop Elliott, who so generously contributed specimens from southern localities a number of years ago, most materially assisting Mr. Bland and myself in our studies.

This species was described by Dr. Lea, from Jasper, Marion Co., Tenn. Sewanee, the University Place of Bishop Elliott, is in Franklin, the adjoining county. These are the only localities of the species thus far known.

Patula mordax, Shuttl.

East Tennessee.

I have lately had an opportunity of examining its genitalia, and find them to agree with those of the typical *alternata*. The dentition is also the same (see Proc. Phila. Ac. Nat. Sc., 1875, pl. VII, fig. 7).

Patula alternata, Say.

I have also examined and here figure (pl. xvii, fig. 15), the genitalia of the heavily ribbed form of *P. alternata*, from Eastern Tennessee (Mr. A. G. Wetherby). It agrees with the typical *P. alternata*, and also in dentition. In both forms I found the duct of the genital bladder much longer than is figured by Leidy, in the Terrestrial Mollusks U. S. In *P. Cumberlandiana* also it is long, thus agreeing with *alternata*.

Patula Huahinensis, Pfr.

Huahine Isl., Mr. A. Garrett.

Lingual membrane, with 18-1-18 teeth, of which about six are laterals. The type of dentition is about the same as in *Endodonta incerta*, herewith described. The marginals are, however, different, the two cutting points being bifid, the base of attachment low and wide. (Plate xvii, fig. 17).

Endodonta incerta, Mousson.

Huahine Island, Mr. A. Garrett.

I am indebted to Mr. Garrett, for the identification of this and all the Huahine species herewith described.

I regret not succeeding in obtaining the jaw of any species of this group, the more because some doubt about its existence has been expressed. It is, however, probable that it will be found, as no agnathous genus has yet been noticed with the quadrate marginal teeth, which characterize *E. incerta*, and also *E. tumuloides*, Garrett (Proc. Ac. Nat. Sc. Phila., 1875, p. 248, pl. xxi, fig. 6).

Lingual membrane (pl. xvii, fig. 16) with 11-1-11 teeth, of which 4 are perfect laterals. The marginals (of which the last is shown in the figure) are but a simple modification of the laterals. They differ from those of *tumuloides*, unless, indeed, I have, from their exceeding minuteness, failed rightly to interpret them.

Helix Ingersolli, Bland (*Microphysa*).

Mr. Ernest Ingersoll: U. S. Survey of Territories, 1874.

Jaw low, wide, slightly arcuate, ends slightly attenuated: whole anterior surface with about 22 broad, flat, slightly separated ribs, whose ends denticulate either margin.

This form of jaw is unusual among the *Helicinae*. It is somewhat like that of *H. Lansingi* (see Phila. Pr., 1875, p. 169).

Lingual membrane long and narrow. Teeth about 16-1-16. Centrals as usual in the *Helicinae* (pl. xviii, fig. C). The side cusps and cutting points are well developed, the base of attachment longer than wide. Laterals of same type, but unsymmetrical, and consequently only bicuspid. The change from laterals to marginals (8th and 9th teeth of figure) is very gradual, there being no splitting of the inner cutting points, at least not as in most species (see pl. xii, fig. E). Marginals (16th tooth of figure) very low, wide, with one inner, long, blunt cutting point, and one outer, small, blunt.

The low, wide marginal teeth of this species are peculiar.

***Helix rufescens*, Pennant (*Fruticicola*).**

Extracted from a dry English shell furnished by Mr. A. G. Wetherby. I include it here because the species has been introduced at Quebec. I was not able to illustrate it when treating of the Lingual Dentition of North American Land Shells, in Proc. Ac. Nat. Sc. Phila., 1875, 214.

There are 26-1-26 teeth. The characters of all are shown in my figures. It will be seen that the transition from laterals to marginals (16 to 19), see also Lehmann, in Malak. Blatt. xvi, is gradual. The inner cutting point is not bifid.

***Helix pubescens*, Pfr. (*Fruticicola*).**

Haiti. Mr. V. P. Parkhurst to Mr. T. Bland.

Jaw (pl. xv, fig. C) thin, semitransparent, low, slightly arcuate, ends scarcely attenuated, blunt; upper margin with a strong muscular attachment: no median projection to cutting edge; anterior surface with about 20 ribs denticulating either margin; these ribs appear in most cases to be broad, flat, with narrow interstices, but in others there are appearances such as I have described in *Bulinulus limnæoides* (see below).

Lingual membrane long and narrow (pl. xv, fig. D). Teeth as usual in the *Helicinae*. The change from laterals to marginals is very gradual, not formed by the splitting of the inner cutting point. The 12th tooth (figured) shows the commencement of the transition. The 22d (figured) is a marginal tooth. The inner cutting point of the marginals is rarely bifid.

Teeth about 24-1-24.

***Helix Studeriana*, Fér. (*Stylodon*).**

Seychelles, Consul Pike to Mr. T. Bland.

Jaw stout, strongly arched, ends but little attenuated, blunt; anterior surface without ribs; there are, however, a few, coarse, broad, vertical

wrinkles. One jaw had a slightly developed median projection to its cutting edge, another has no approach to a projection.

Plate xiv, fig. C, shows the lingual dentition. Teeth 69-1-69, with about 22 laterals. There is considerable resemblance to the dentition of *H. fringilla* herewith described. The cutting points on centrals and laterals are, however, more pointed.

This species is viviparous.

***Helix dentiens*, Fér. (*Dentellaria*).**

See Proc. Ac. Nat. Sc. Phila., 1874, p. 57. I now offer fig. G of pl. xvi, to give more full details of the changes of the teeth from centrals to marginals, especially the side cusp and cutting point of the outer laterals, and the transition from laterals to marginals. Tooth 33 is the last.

***Helix aspera*, Fér. (*Thelidomus*).**

Jamaica. Mr. V. P. Parkhurst to Mr. T. Bland.

For jaw and lingual membrane see Amer. Journ. Conch. VI, 204.

Pl. xii, fig. 2, represents the genital system. The genital bladder (g. b.) is elongated oval, on a short, stout duct. The penis-sac (p. s.) is stout, long, tapering bluntly to its apex, somewhat below which is the entrance of the vas deferens. The retractor muscle is inserted at about the middle of the length of the penis-sac.

***Helix Jamaicensis*, Chemn. (*Thelidomus*).**

Jamaica. Mr. V. P. Parkhurst to Mr. T. Bland.

Mr. Bland has already called attention (Ann. Lyc. N. H. of N. Y. XI, 146, 1875) to the true subgeneric position of this species. I propose here only to give a figure of the dentition and genitalia.

There are 41-1-41 teeth on the long and narrow lingual membrane (pl. xiv, fig. B).

Jaw thick, arcuate, ends attenuated: anterior surface with 14 decided but unequal, irregularly disposed ribs, denticulating either margin.

Genitalia figured on pl. xiii, fig. F. The peculiarity of it is the extremely long epididymis (e), convoluted at either end. The penis-sac has a contraction at its middle, below which it is black, above it, white.

***Helix crispata*, Fér. (*Eurycratera*).**

Port au Prince. Mr. V. P. Parkhurst to Mr. T. Bland.

Lingual membrane and jaw already described (see Proc. Acad. Nat. Sc., 1874, 57, pl. x, fig. 9*).

Plate xii, fig. 8, represents the lower portions of the genital system. The genital bladder (g. b.) is very small, globular, on a long duct, which is very narrow in its upper half and gradually enlarges below until it becomes very stout. On the penis-sac (p. s.), above the junction of the retractor muscle, is a small globular mass, of character unknown to me.

***Helix spinosa*, Lea (*Stenotrema*).**

Tennessee. Mr. A. G. Wetherby.

Plate xii, fig. 3, represents the genital system of this species. The penis-sac (p. s.) is very long, attenuated at either end, greatly swollen at the median third of its length. The genital bladder is oval, on a short duct.

***Helix stenotrema*, Fér. (*Stenotrema*).**

Tennessee. Mr. A. G. Wetherby.

The genitalia are as figured for *hirsuta* by Dr. Leidy, in Terr. Moll. U. S. There is, however, in this species, a much greater development of prostate, testicle and epididymis. The last named organ is scarcely convoluted. The margins of the first named are scalloped.

***Helix barbigera*, Redf. (*Stenotrema*).**

Genitalia as in the last species.

***Helix tridentata*, Say (*Triodopsis*).**

On pl. xvii, fig. 19, I have given the genitalia of this species. They may be compared with those of the other species of *Triodopsis* given below. The genital bladder with its duct offer slight variations in all these species; whether constant or not must be decided by future study. My figures will draw attention to this point.

***Helix fallax*, Say (*Triodopsis*).**

Genitalia (pl. xvii, fig. 11). See last species.

* There are decided side cutting points to centrals and laterals, though I failed to see them in the lingual figured.

Helix Hopetonensis, Shuttl. (*Triodopsis*).

City of Charleston, S. C.

Genitalia (pl. xvii, fig. 14). See above, *H. tridentata*.

Helix Van Nostrandii, Bland, MS. (*Triodopsis*).

Aiken, S. C. Miss Emma Van Nostrand.

Jaw as usual in *Triodopsis*: ribs 17.

Lingual membrane (pl. xvii, fig. 8) long and narrow. Teeth 24-1-24, with 10 laterals. The centrals have no distinct side cusps or cutting points, but the latter are replaced by decided bulgings on the median cutting point. The figure gives the central with the first, tenth, eleventh, nineteenth and twenty-fourth teeth; the last two are marginals.

Genitalia (pl. xvii, fig. 12). See above under *H. tridentata*.

Helix Rugeli, Shuttl. (*Triodopsis*).

East Tennessee. Mr. A. G. Wetherby.

Genitalia (pl. xvii, fig. 18). See above under *H. tridentata*.

Helix Harfordiana, J. G. Cooper (*Triodopsis*).

California. Mr. Henry Hemphill to Mr. T. Bland.

Lingual membrane (pl. xviii, fig. A) as usual in the subgenus (see Proc. Ac. Nat. Sc. Phila., 1875, 206). Teeth 26-1-26, with 12 laterals. The side cutting points to central and lateral teeth are well developed.

Jaw as usual in the subgenus (see same references as above), with over 12 ribs.

Helix fringilla, Pfr. (*Merope*).

Admiralty Island. Mr. A. G. Wetherby.

The dried remains of the animal in the shell of a cabinet specimen furnished the lingual membrane and jaw here described. The shell is the variety with the pink peristome.

Jaw with numerous, crowded, stout ribs, denticulating either margin.

Lingual membrane (pl. xiv, fig. A, pl. xv, fig. A) long and narrow. Teeth 28-1-28, with about 11 laterals. Centrals with base of attachment longer than wide; side cusps obsolete, side cutting points wanting; middle cusp broad, blunt, with a very short, broad, blunt cutting point.

Laterals like the centrals, but unsymmetrical: the cutting point becomes longer as they pass off laterally, and at the 12th tooth it commences to be bluntly trifid. The marginals are peculiar; their base of attachment is subquadrate with a single broad cusp, bearing a very broad, oblique, expanding, trifid cutting point; the outer division very small, pointed; the median longer, very broad, squarely truncated; the inner one about half the size of the median, recurved and sharply pointed.

In pl. xiv, fig. A, I have represented the dentition of that portion of the lingual membrane where the cutting points are least developed. Pl. xv, fig. A, represents that portion where they are most so. It must always be borne in mind that such differences of development exist in all membranes.

The dentition of this species is peculiar, resembling that common in *Orthalicus* rather than the type usual in *Helix*.

***Helix leporina*, Gould (*Polygyra*).**

Texas. Mr. A. G. Wetherby.

Jaw as usual in the subgenus (see Phila. Proc. 1875, 201), with 12 ribs.

Lingual membrane as usual in the subgenus (see id.). Teeth 18-1-18, with 8 laterals (pl. xviii, fig. B). The 15th tooth figured is from another portion of the membrane from that furnishing the 13th. The extreme right hand figure of my plate represents a deformed first lateral tooth.

***Helix auriculata*, Say (*Polygyra*).**

St. Augustine, Florida, under the ruins of the sugar house chimneys at Hanson's deserted plantation.

Having collected specimens of undoubted identity at Mr. Say's original locality, I have compared the genitalia with those figured by Leidy (Terr. Moll. U. S., I. pl. ix) and find them to agree. This is important, as the name "*auriculata*" was used in that work to cover several species.

I have also given (pl. xviii, fig. E) a better figure of the dentition than in Proc. Phila. Ac. Nat. Sc., 1875, pl. viii, fig. 12. There are 26-1-26 teeth. The inner cutting point of the 13th tooth is bifid, so that there are 12 laterals.

Jaw with 10 ribs.

***Helix uvulifera*, Shuttl. (*Polygyra*).**

Genitalia as in *H. auriculata*.

***Helix septemvolva*, Say (*Polygyra*).**

St. Augustine, Florida.

Plate xii, fig. 6, represents the genital system of the large form of this

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species. It is characterized by its extreme length, as would be expected from the form of the shell. The vagina (v.) is extremely long and narrow. The genital bladder (g. b.) is elongated oval, on a short, slender duct. The penis-sac (p. s.) is very long, attenuated to a point above, where the retractor muscle is inserted.

The digestive system is also very much elongated. The œsophagus especially is excessively long, as are also the ducts to the salivary glands.

This species is extremely common all over St. Augustine and its vicinity. The large form I found almost restricted to the moat of the old fort, especially at the foot of the main western wall.

Helix Febigeri, Bland (*Polygyra*).

Near Mobile, Alabama. Dr. E. R. Showalter.

Genitalia as in *H. septemvolva* (see pl. xii, fig. 6).

Helix cereolus, Muhlf. (*Polygyra*).

For this and many species of Key West I am indebted to the kindness of Mr. W. W. Calkins.

Jaw as usual in the subgenus (l. c.), with over 14 ribs.

Lingual membrane as usual (pl. xvi, fig. C). Teeth 22-1-22, with 9 laterals, the inner cutting point of the 10th tooth being bifid. Marginals with base of attachment low, wide, with one inner, long, oblique, bifid cutting point, and one short, bluntly bifid, small, outer cutting point.

Genitalia as in last species.

Helix Carpenteriana, Bland (*Polygyra*).

Key West. Mr. W. W. Calkins.

Jaw as usual in the subgenus: (l. c.): ribs over 12.

Lingual membrane as usual (pl. xiii, fig. K). Teeth 22-1-22. The character of the various teeth is shown in the figures. There are 9 laterals, the 10th tooth having a bifid inner cutting point.

I can now state that *H. cereolus*, *Carpenteriana*, *septemvolva*, *volvoxis*, and *Febigeri* have the same dentition. In all, the splitting of the inner cutting point commences at the tenth tooth.

Genitalia as in *H. septemvolva* described herewith.

Helix exoleta, Binn. (*Mesodon*).

I have already referred to the peculiarity of this species in sometimes having, and sometimes wanting, side cutting points to outer lateral teeth, and a bifurcation to the inner cutting point of the marginals (see Proc. Phila. Ac. Nat. Sc., 1875, 243). I here figure teeth from a lingual membrane differing in this respect from that figured by me before (l. c. pl. xi, fig. 7). The cutting point of the central and first lateral teeth have a lateral bulging which represents the side point.* This point appears about the 11th tooth.

Plate xvi, fig. D. E. The 60th tooth is the last.

Fig. E represents an inner marginal tooth from another membrane, agreeing with my former figure in having a simple, not bifid, inner cutting point.

I am sure of the identity of each individual examined, having verified it by the peculiar genital bladder and penis-sac, figured by Leidy, l. c.

Helix ruficincta, Newc. (*Arionta*).

Catalina Isl., California. Mr. Henry Hemphill.

Plate xiii, fig. A, shows the genitalia. There are no peculiar accessory organs, as in *ramentosa*, *Nickliniana*, *Kelletti*, etc. (see Proc. Phila. Acad. Nat. Sc., 1874, pl. iii, iv). A dart sac? (*d. s.*) is, however, present.

Helix Carpenteri, Newc. (*Arionta*).

Coronado Islands, coast of Lower California. Mr. Henry Hemphill.

Genitalia as in *H. Nickliniana* (see Proc. Ac. Nat. Sc. Phila., 1874, pl. iv, fig. 3). The flagellate ends of the vaginal prostate are shorter in this species.

Jaw as usual in the subgenus (see Proc. Ac. Nat. Sc. Phila., 1875, 216), with over seven ribs.

Lingual membrane long and narrow. Teeth 48-1-48, with 20 laterals. See pl. xv, fig. B. It will be seen that the central and first lateral teeth have no side cusps or cutting points; it appears first on the 8th tooth. The change from laterals to marginals is formed as usual, the inner cutting point of the 21st tooth being bifid. A marginal is shown in the 34th tooth.

* I fear that in my figure of the dentition of *M. albolabris* (l. c.) I have mistaken this bulging for a distinct cutting point. The membranes of all our species should be carefully restudied with the view of learning whether there is any difference other than of degree between this bulging and a distinct cutting point. The figures of Semper (Phil. Archip.) should be carefully studied, as they show best the two planes of the cusp and cutting point.

***Helix Ayresiana*, Newc. (*Arionta*).**

San Miguel Isl., California. Mr. H. Harford.

Genitalia as in *H. Traski* (see Ann. Lyc. N. H. of N. Y., XI, 30, pl. vi, fig. 4). The flagellate extensions of the vaginal prostate beyond the bulbs in this species are, however, much shorter and stouter.

***Helix exarata*, Pfr. (*Arionta*).**

Alameda Co., California. Dr. L. G. Yates.

Genitalia as in *H. Nickliniana*, Proc. Ac. Nat. Sc. Phila., 1874, pl. iv, fig. 3.

***Helix Diabloensis*, J. G. Cooper. (*Arionta*).**

Alameda Co., California. Mr. L. G. Yates.

Jaw as usual in the genus, (see Proc. Phila. Ac. Nat. Sc., 1875, 216), with 5 ribs.

Lingual membrane (pl. xv, fig. G), as usual in the subgenus. The central and first lateral teeth have no side cusps or cutting points; these appear on the 13th tooth. The 18th tooth has its inner cusp bifid; there may, therefore, be said to be 17 laterals. The marginals (see figure for the last one), are low, wide, with one inner, long, oblique, bifid cutting point, and one outer small cutting point. There are 37-1-37 teeth.

Genitalia as in *H. exarata*.

***Helix arrosa*, Gould (*Arionta*).**

Plate xii, fig. 5, gives the genital system.

The penis-sac is extremely long and gradually tapers into a flagellum. It receives the retractor muscle beyond the middle of its length, and the vas deferens at three-quarters of its length from the vagina. The genital bladder (g. b.) is very small, oval, on a very long duct, which has a very long, stouter, accessory duct (a. d.).

From *H. Nickliniana*, *H. arrosa* differs greatly in the total want of the peculiar accessory organ, probably a vaginal prostate, which characterizes that species (see Phila. Proc. 1874, 41, pl. iii, fig. 4). From *H. Townsendiana*, it still more widely differs (see same, 1873, 254, pl. i, fig. 4), in the character of the penis-sac and genital bladder.

***Helix facta*, Newc. (*Arionta*).**

Sta. Barbara Island, California. Mr. H. Hemphill.

In my account of the dentition of North American Land Shells in Proc. Phila. Ac. Nat. Sc., 1875, I was unable to include this species.

Jaw already described.

Lingual membrane long and narrow (pl. xvii, fig. 13). Teeth 26-1-26, as usual in *Arionta*. The fourth has decided side cusp and cutting point, which on the central and first three laterals are replaced by a prominent bulging of the large cutting point. The thirteenth tooth has its inner cutting point bifid. My figures give the central with the first, fourth, twelfth, thirteenth, seventeenth and twenty-sixth teeth, the last two being marginals.

Genitalia (pl. xvii, fig. 9) without the accessory duct of the genital bladder, and with a dart sac (?). They resemble nearly those of *H. ruficincta* (see above), differing chiefly in the length of the duct of the genital bladder. At the base of the dart sac there appear two simple, thread-like organs, reminding me of those of *H. Stearnsiana*, but without their terminal complications. I have not figured them, being uncertain whether they should be considered as a part of the genital system.

Helix Tryoni, Newc. (*Euparypha*).

Sta. Barbara Island, California. Mr. H. Hemphill.

Jaw already described by me (L. & Fr. W. Shells, I. 179).

Lingual membrane (pl. xvii, fig. 5) long and narrow, quite as in *Arionta*. Teeth 42-1-42. The eleventh lateral has a decided side cusp and cutting point. The 14th has its inner cutting point bifid. The characters of the individual teeth are shown in the figure, which gives the central, the first, eleventh, fourteenth, thirty-seventh and forty-second teeth.

Genitalia (pl. xvii, fig. 10) as usual in *Arionta*, especially in *H. Stearnsiana*, but with this important difference, that from the base of the dart sac one thread-like organ alone proceeds, the other being replaced by a sponge-like process, evidently a form of vaginal prostate.

Anadenus ?

Himalaya Mts. Museum of Comparative Zoology, Cambridge, through Mr. Anthony.

On pl. xviii, fig. 1, I have figured the dentition of this slug, whose specific name is unknown to me. There are 58-1-58 teeth.

The jaw is thick, low, wide, slightly arcuate; ends but little attenuated: anterior surface with 14 stout, unequal, separated ribs, denticulating either margin.

The dentition is of the same type as described in the genus by Heyne-mann, Malak. Blatt. X, 1863, p. 138.

***Orthalicus undatus*, Brug. Var.**

Key West. W. W. Calkins.

This is the form figured as *O. zebra*, Müll., in Terr. Moll. U. S., IV, pl. lxxviii, fig. 12, and L. & Fr. W. Sh. N. A., I. p. 216, fig. 370 (not fig. 371). It has also been found on Indian Key, Sandy Key, Cape Sable and Key Biscayne.

Mr. Calkins kindly sent me specimens preserved in spirits. The genitalia are like those of the typical *O. undatus*, from Jamaica (see Ann. N. Y. Lyc., N. H., XI, 41). So also is the jaw.

The lingual dentition I have figured on pl. xiii, fig. E, giving one central with its adjacent lateral, and one marginal tooth. There are 126-1-126 teeth. The cutting points are somewhat more developed than in the typical *undatus* (see Proc. Ac. Nat. Sc. Phila., 1875, pl. vi, fig. D).

***Ariolimax Hemphilli* (n. sp.).**

From Mr. Henry Hemphill I have received specimens of an undescribed species of *Ariolimax*, collected by him at Niles Station, Alameda Co., California.

It is from 25-31 mill. long, of a transparent flesh color, much more slender than the other known species, with a much more pointed tail. The mantle is also longer. These characters, even in specimens preserved in alcohol, readily distinguish the species. On dissecting the specimens, I also found distinguishing specific characters in the genitalia (pl. xii, fig. 7). The testicle (t.) embedded in the liver, is brown, composed of thickly packed fasciculi of long, blunt cœca, the mass formed by them is cuneiform. The ovary (ov.) is narrow and pointed. The genital bladder (g. b.) is small, oval, with a short, narrow duct, which becomes much more swollen at its junction with the vagina. The penis sac (p. s.) is extremely short, globular, receiving the vas deferens at its upper posterior portion, and the retractor muscle at its farther end. Opposite the mouth of the penis sac the vagina is greatly swollen.

A comparison with my figures of the genitalia of *A. Andersoni*? (pl. xii, fig. 9), and *A. Columbianus*, *Californicus* and *niger* (Phila. Proc., 1874, pl. ii and xi), will show how widely they differ from those of the present species.

The jaw is thick, low, wide, slightly arcuate, ends scarcely attenuated; anterior surface with 8-12 decided ribs, denticulating either margin.

Lingual membrane (pl. xviii, fig. H) as usual in the genus (see Phila. Proc., 1875, 193). Teeth 31-1-31.

Ariolimax Andersoni, J. G. Coop.?

From Mr. L. G. Yates I have received specimens of an *Ariolimax* found in the mountains of Alameda Co., California. From the fact of the reticulations of the surface of the animal having the foliated appearance noticed in *Arion foliolatus*, Gld., *Prophysaon Hemphilli*, Bl. & Binn., and *Arion Andersoni*, J. G. C., I am inclined to refer the specimens to one of those species. I am entirely unacquainted with the first (see Ann. N. Y. Lyc. N. H., X, 297), the second is generically distinct, the latter may be identical.* The specimens have all the characters of *Ariolimax* (see Proc. Ac. Nat. Sc. of Phila., 1874, 33). They are about 35 mill. long.

The jaw is as usual in the genus, wide, low, with about 13 broad, separated ribs, denticulating either margin. The lingual membrane is as usual. Teeth 48-1-48. The characters of the teeth are sufficiently shown in my fig. G, of plate xii. The change from laterals to marginals is very gradual (43), the latter being but a simple modification of the former.

The genitalia (pl. xii, fig. 9) are very much like those of *A. niger* (see Phila. Proc. l. c., pl. xi, fig. C), especially in the shape of the penis-sac, and the peculiar accessory organ (v. p.), probably a vaginal prostate. The genital bladder differs somewhat in shape, and also the testicle.

The rudimentary shell has decided concentric layers. The caudal mucus pore is as in *A. Columbianus* (Phila. Proc. l. c., pl. ii, fig. B).

Should this not prove the species described as *Arion Andersoni* by Dr. J. G. Cooper, it must receive a new name. It is a true *Ariolimax*, most nearly related to *A. niger*. The latter species wants the foliated reticulations, and has its posterior termination more blunt, with a decided lateral cleft at the mucus pore.

*I have lately received from Dr. Cooper, under the name of *Arion Andersoni*, specimens agreeing perfectly with the form of *Prophysaon* referred to as probably undescribed on p. 296, and pl. xiii, fig. 5, of Ann. of Lyc. of N. H. of N. Y., vol. X. Should Dr. Cooper's *Arion Andersoni* prove, therefore, to be a *Prophysaon*, it will retain its specific name, while the slug before us may also retain the specific name *Andersoni*.

Binneya notabilis, J. G. Coop.

Sta. Barbara Island, California. Mr. Henry Hemphill.

Mr. Hemphill, who has contributed so largely to our knowledge of the land shells of the Pacific coast, has lately visited the Island of Sta. Barbara. Among the species found by him is *Binneya notabilis*, which was originally described from thence by Dr. J. G. Cooper. Mr. Hemphill has kindly sent me living specimens, as well as others preserved in spirits. I am, therefore, able to give a full generic description, with a figure (pl. xvii, fig. 4) of the animal as it appears when half extended. I did not succeed in inducing it to protrude itself fully. The descriptions will supersede those formerly given by Mr. Bland and myself in L. & Fr. W. Sh. N. A., I. 67.

When received, the living examples were furnished with the peculiar epiphragm described by Dr. Cooper. On becoming again active, this epiphragm was left entire, still adhering to the surface on which the animal had formed it. In one individual I observed a second, inner epiphragm, simple, without the perpendicular walls.

The Mexican genus *Xanthonyx*, is no doubt nearly allied to *Binneya*, but it does not appear from the figures of alcoholic specimens given by Messrs. Fischer and Crosse (Moll. Mex. et Guat.) that the mantle of *Xanthonyx* is extended anteriorly, and the position given by them of the respiratory office is different. Should future study of the living animal prove *Xanthonyx* identical with *Binneya*, the former will be considered as a synonyme of the latter.

Dr. Pfeiffer (Mon. Hel. Viv. VII) suggests the identity of *Binneya* with *Daudebardia*, ignoring entirely the distinction of the first divisions now recognized among the *Geophila* of presence or absence of a jaw, or of aculeate or quadrate teeth. By the modern arrangement these two genera are most widely separated.

The surface of the animal is dirty white, with about seventeen vertical rows, on each side, of dark blue or slate blotches, interrupted by the longitudinal reticulations running parallel to the foot, but again commencing and extending to the edge of the foot. These blotches diverge in all directions from under the shell and mantle, running almost perpendicularly on the side of the animal, but very obliquely in front and behind. The tail is quite keeled with oblique blotches. These blotches also run obliquely from a median line on the fore part of the extended animal. Tentacles, eyepeduncles and front of head slate color. Lips developed and kept constantly in motion as tentacles. The reticulations of the surface are large and few.

In specimens preserved in alcohol there appears a locomotive disk. There is no caudal pore. The respiratory and anal orifices are far behind the centre of the mantle edge on the right of the animal. The genital orifice appears somewhat behind the right eyepeduncle. The mantle is scarcely reflected upon the shell, even in front. When the animal is fully extended, Dr. Cooper says the mantle equals one-fourth of its length. The mantle exudes mucus freely. It seems fixed to the shell, not changing its position with the movements of the animal.

One of the shells collected by Mr. Hemphill is twice as large as that whose measurements are given by Mr. Bland and myself.

The jaw is thick, slightly arcuate, ends blunt: anterior surface with six well developed ribs denticulating either margin, situated on the central third of the jaw, and as many subobsolete ribs on each outer third: no median projection. Pl. xvii, fig. 2.

Lingual membrane (pl. xvii, fig. 3) long and narrow. Teeth 31-1-31, with about fifteen laterals, but the change into marginals is very gradual, the latter being a simple modification of the former. My figures give a central with the first, sixteenth and thirty-first teeth.

The genitalia I did not succeed in extracting, they being but imperfectly developed in the individuals received. The nervous ganglia and the digestive system present no peculiar features.

The generic description will be as follows:—

Animal heliciforme, antice obtusum, postice rapide acuminatum. Pallium subcentrale, extra testam antrorsum prolongatum. Discus gressorius distinctus. Porus mucosus caudalis nullus. Apertura respiratoria et analis ad dextram sita, in parte posteriore marginis pallii. Apertura genitalis post tentaculam dextram oculigeram.

Testa externa, paucispira, haliotoidea, animal non includens. Pars exclusa in hibernis epiphragmate albido, duro, membraneo protecta.

Maxilla arcuata, costis validis exarata. Dentes linguales quadratæ, centrales tricuspidatæ, laterales et marginales bicuspidatæ.

Coecilianella Gundlachi, Pfr.

St. Martin. Dr. H. E. Rygersma to Mr. T. Bland.

Mr. Bland has already noticed this species in *Ann. Lyc. Nat. Hist. of N. Y.*, XI, 152, 1875, where a detailed description of the jaw and lingual membrane will be found.

I add a figure of the jaw (pl. xiii, fig. D), with a still more enlarged view of a portion of it (fig. G), to show the character of the ribs. As stated in the article referred to, these ribs are quite different from those described by Sordelli for *C. acicula*.

Pl. xiii, fig. H gives a camera lucida drawing of a central, lateral and marginal tooth. Fig. 1 gives a still more magnified view of the transition and marginal teeth, not drawn, however, by camera lucida.

Jaw low, wide, slightly arcuate, ends attenuated; whole surface covered with about 22 crowded, broad, flat ribs, denticulating either margin.

Lingual membrane long and narrow. Teeth 18-1-18, with 4 perfect laterals. Centrals with their base of attachment long, narrow, their reflected portion about one-half the length of the base of attachment, tricuspid; the middle cusp stout, with a short blunt cutting point, side cusps subobsolete, but with small, distinct cutting points. Lateral teeth with their base of attachment subquadrate, much longer, and very much broader than that of the centrals, the reflected portion short, stout, tricuspid, the middle cusp very stout and long, reaching the lower edge of the base of attachment, beyond which projects the short, stout cutting point; side cusps subobsolete, but bearing distinct, though small cutting points. There are four perfect laterals, the fifth tooth being a transition to the marginals, by the base of attachment being lower, wider, not exceeding the reflected portion, with one inner large cusp bearing one outer large cutting point representing the outer cutting point of the first four lateral teeth and one inner, still larger, cutting point, representing the middle cutting point of the first four laterals, and one smaller, outer cusp, bearing one small, sharp, bifid cutting point, representing the outer side cutting point of the first four laterals. The sixth tooth has the largest cutting point bifid. The balance of the teeth are true marginals. They are very low, wide, with two low, wide cusps, bearing each several irregular, blunt cutting points.

The dentition of this species is, as would be anticipated, of the same type as the allied *Coecilianella acicula* as figured by Lehmann (*Lebenden Schnecken Stettins*, p. 128, pl. xiii, fig. 43, and Sordelli, l. c., fig. 26). The jaw, however, has no appearance of the "brace" like ribs described in that species by Sordelli (*Atti Soc. Ital. Sc. Nat.*, XIII, 1870, 49, pl. i, fig. 25). The ribs are quite like those figured of *Helix Lansingi* (*Ann. Lyc. Nat. Hist. N. Y.*, XI, p. 75, fig 2 A) although they are narrower.

***Stenogyra juncea*, Gld.**

Island of Huahine. Mr. A. Garrett.

The species was described originally as a *Bulimus*, in which genus it is retained by Pfeiffer. I do not find it in die Heliceen, ed. 2.

Lingual membrane with 28-1-28 teeth, eight of which are laterals. Teeth as in *S. hasta* as figured by me, Proc. Ac. N. S. Phila., 1875, pl. xx, fig. 2.

***Strophia incana*, Binney.**

Key West. Mr. W. W. Calkins.

Jaw already described (Proc. Acad. Nat. Sc. Phila., 1875, p. 190, fig. 37).

Lingual membrane (see above reference) with 27-1-27 teeth. The change from laterals to marginals is as shown in the ninth and tenth tooth. There is the usual splitting of the inner cutting point beyond the ninth tooth. The extreme marginals are low, wide, with one inner, long, bluntly bifid cutting point and one outer, short.

All the changes from centrals to extreme marginals are shown in the figures. Pl. xiii, fig. J.

The splitting of the inner cutting point of the marginals was not detected by me before in *S. iostoma* and *numia*. I have, however, lately found it in those species.

***Bulimulus pallidior*, Sowb.**

Lower California. Mr. A. G. Wetherby.

Plate xii, fig. 1, represents the genital system. The penis sac is long, tapering at its end, where the retractor muscle is inserted. The genital bladder (g. b.) is globular, on a long, stout duct.

***Bulimulus limnæoides*, Fér.**

St. Kitts. Dr. Branch to Mr. T. Bland.

Jaw (pl. xvi, fig. A.) low, wide, semitransparent, slightly arcuate, ends scarcely attenuated, blunt: anterior surface with about sixteen ribs, denticulating either margin. It is extremely difficult to decide upon the character of these ribs. Some appear to be a simple thickening of the jaw formed by the overlapping of distinct separate plates. Others remind me of the distant narrow ribs of most of the *Bulimuli*, of the character of the ribs in *Cylindrella*, etc. At other points upon the jaw there seem to be broad, flat ribs with narrow interstices.

Lingual membrane long and narrow (pl. xvi, fig. B.). Teeth as usual in the *Helicinæ*. The change from laterals to marginals is very gradual, the latter being but a modification of the former, with two cutting points, the inner the longer. Thus it appears that this species in its dentition agrees with *B. cinnamomeo-lineatus*, *pallidior*, *chrysalis*, *dealbatus*, *Guadalupensis*, *alternatus*, *sporadicus*, *solutus*, *sepulcralis*, *durus*, *Peruvianus*, *rhodolarynx*, and not with *laticinctus*, *Bahamensis*, *auris-leporis*, *papyraceus*, *Jonasi*, *membranaceus*, *trigonostomus*, *flavidus*, *virginalis*, *convexus*, *Vincentinus*, *Lobbi*, *alternans*, *multifasciatus*, *primularis* (see Ann. Lyc. N. H. of N. Y., XI, 34 et seqq.).

Teeth 30-1-30 with about ten laterals. The outer cutting point of the marginals is sometimes bifid.

***Cylindrella Poeyana*, Orb.**

Key West. Mr. W. W. Calkins.

Jaw as usual in the genus, with about 40 delicate ribs.

Lingual membrane long and narrow (pl. xv, fig. F). Teeth 14-1-14 of the same type as I have already shown to exist in this subgenus *Gongylostoma* (see *C. elegans*, Pfr. Proc. Phil. Ac. Nat. Sc., 1875, pl. xx, fig. 6).

***Cylindrella ornata*, Gundl. (*Gongylostoma*).**

Cuba. Cabinet of Mr. Bland.

Jaw not observed.

Lingual membrane with 18-1-18 teeth, of which three only are well formed laterals, the change to marginals being very gradual. The type of dentition is the same as I have described in *C. Poeyana* (see above). It will be noticed in my figure F of plate xv, that there is a slender, simple, upper prolongation or pedicle above the inner, palmate cutting edge, as well as the pedicle on which the outer cutting edge rests. This is the case also in *C. elegans* and *C. Poeyana*, and may, therefore, be considered characteristic of the section *Gongylostoma*.

***Amphibulima Rawsonis*, Bland in litt.**

Governor Rawson to Mr. T. Bland. Island of Montserrat, between Nevis and Guadeloupe.

Plate xiii, fig. C, represents the genital system. There are no accessory organs.

The jaw is as usual in the genus (see Proc. Phila. Ac. Nat. Sc., 1874, pl. viii, fig. 2, for that of *A. rubescens*). About 33 ribs, those at the upper centre of the jaw running obliquely and meeting or ending before reaching the lower margin.

Lingual membrane (pl. xiv, fig. E) as usual in the genus. Centrals with the base of attachment very much larger than that of the laterals, and with an enormous, single, broad, long, rapidly and obtusely pointed cutting point. No side cusps or side cutting points. Laterals of the form usual in the *Helicinæ*, with a stout, inner cusp, bearing a broadly truncated, short cutting point, and a small side cusp bearing a short cutting point.

The change from laterals to marginals is shown in the 10th, 15th and 27th teeth in the plate.

The marginals (28th and 68th teeth in the plate) have a long, narrow base of attachment, which near its lower margin bears a short, slightly expanding, bluntly trifid cusp: from this cusp springs a short, expanding, bluntly denticulated, broad, cutting edge, the inner denticle the largest. This cutting edge is shown in the 67th and 68th teeth on a more enlarged scale. There is great variation in the denticulation of the cutting edge.

There are 68-1-68 teeth.

The peculiarity of this membrane is the enormous development of the central tooth.

I have (l. c.) given figures of the dentition of *A. patula*, Brug., of St. Kitts and of Dominica, of *A. appendiculata*, Pfr. of Guadeloupe, and of *A. rubescens*, Fér. of Martinique.* Dr. Fischer (Journ. de Conch. XXII, 1874, pl. v), figures that of *A. depressa* of Guadeloupe, and *A. patula* of Guadeloupe.

Dr. Fischer also (l. c.) figures the dentition of *A. rubescens*. He gives inner side cutting points to the lateral teeth which I did not find in my specimens. His figure of the dentition of the Guadeloupe *A. patula* is certainly specifically distinct from the St. Kitts and Dominica form. It seems as if there were the following distinct species of *Amphibulima*: *depressa*, *appendiculata*, *rubescens*, *patula* of Guadeloupe, *patula* of St. Kitts and Dominica and *Rawsonis*.

It is with extreme regret that I find the *Amphibulimæ* still treated as species of *Succinea* by Dr. Pfeiffer in vol. VII of his Monographia, even as late as the present year. Messrs. Fischer and Crosse, as well as Mr. Bland and myself, have

* My friend Mr. Bland and myself were indebted to Gov. Rawson of Barbados, for specimens of this last, as well as for many other valuable West Indian species. The sense of our great obligation to him is increased at this moment by hearing that he has left Barbados to settle permanently in England.

shown the genus to be widely distinct from *Succinea*, in its jaw, its lingual membrane, and its genital system.

***Succinea campestris*, Say.**

St. Augustine, Fla.

Genitalia as in *S. obliqua*, Say, figured under the name of *S. ovalis*, by Leidy, Terr. Moll. U. S., I. pl. xiii. fig. 1-3.

***Succinea pallida*, Pfr.**

Raiatea Isl. Mr. A. Garrett.

Lingual membrane (pl. xvii, fig. 7) with 30-1-30 teeth, with about eleven laterals, but the change into marginals is very gradual. The figure shows a central, first lateral and a marginal in the fifteenth tooth.

Jaw as usual in the genus: no anterior ribs.

***Succinea papillata*, Pfr.**

Huahine Isl. Mr. A. Garrett.

• Jaw as usual: no anterior ribs.

Lingual membrane (pl. xvii, fig. 6) with 25-1-25 teeth; nine laterals, the tenth tooth having its inner cutting point bifid. Some of the outer laterals have their outer cutting point bifid.

***Tornatellina aperta*, Pease.**

Huahine Isl. Mr. A. Garrett.

Among the species received from Mr. Garrett were two of this genus, *T. aperta*, Pse. and *T. oblonga*, Pse. I did not succeed in extracting the jaw of either. With the lingual membrane I was more fortunate, which is the more satisfactory from the fact of the dentition being quite similar to that which Mr. Bland and myself have described for *Achatinella*, s. s., *Partulina*, etc., sub-genera of *Achatinella* (Ann. Lyc. N. H. of N. Y., X. 331). From the exceeding minuteness of the individual teeth I find great difficulty in counting the cutting points. They seem to be about eight, in the form of regular denticles, not of unequal size as in *Achatinella*.

Tornatellina is recognized as a genus by Pfeiffer (Mon. VI), but by von Martens (Die Heliceen) is considered as a subgenus of *Cionella*. It now remains to be seen whether this peculiar dentition is shared by other species.



I am indebted to my friend, Mr. A. T. E. Lansing, for the drawing of the teeth here given. It represents the central, with the first and second side teeth. There are an exceedingly large number of teeth beyond this, of the same type quite to the exterior margin of the membrane. The teeth are arranged obliquely in waving

rows, as is also the case in *Achatinella*.

***Tornatellina oblonga*, Pease.**

Island of Huahine. Mr. A. Garrett.

Dentition same as in the preceding species.

***Achatinella*.**

Already in connection with my friend, Mr. T. Bland (Ann. Lyc. Nat. Hist. of N. Y., X, 331, pl. xv), I have described and figured the jaw and lingual dentition of several groups or subgenera of *Achatinella*. Recently, I have received from Mr. J. G. Anthony, some more specimens in alcohol. I am indebted to Mr. J. H. Redfield for their identification.

I find *A. marmorata*, Gould, of which *A. plumbea*, Gul., already examined, is a synonyme, of the subgenus *Partulina*,* to have the same dentition as we have shown to characterize that subgenus as well as *Achatinella* s. s.

Of *Leptachatina* there was the following: *textilis*, Fér. The dentition is as in the other species of the subgenus examined by me. There are 26-1-26 teeth, with 8 laterals. On pl. xiv, fig. G, I figure the transition from lateral to marginal teeth, and two decided marginals. These last

* I use the subgeneric names of Von Martens.

show the two cutting points which characterize the section *b* (see my paper referred to above, p. 334). On the same membrane, however, are some marginals having three cutting points and some which are quite pectinate, being, therefore, like my section *c* to which I formerly referred the subgenus. This variation shows that my distinction between *b* and *c* was not well founded.

Of *Laminella* there was one species: *A. obesa*, Newc. The jaw is like my fig. 7 (l. c.). Teeth 27-1-27, of same type as other species of the subgenus (see my paper, l. c.). I have, however, figured the 10th tooth (pl. xiv, fig. H), to show that here, again, I do not find the character of only two cutting points to be constant in the marginals, the outer cutting point being trifid in the tooth figured.

Of *Newcombia* there was *A. venusta*, Mighels. There are 24-1-24 teeth, with about 8 laterals (pl. xiv, fig. D). Here, again, the marginals figured are pectinate, though others are simply with two cutting points as I formerly (l. c.) supposed the case in all species of this subgenus. Jaw slightly arcuate, with blunt ends; a few vertical wrinkles.

From my finding the variation I have noted above in the marginal teeth of *Leptachatina* and *Newcombia*, I am forced to doubt the accuracy of the distinction in my sections *b* and *c* (see l. c.).

There were also specimens of *Achatinella auricula*, Fér., which is included in *Achatinella* by Pfeiffer (Mon. VI), but referred by von Martens to *Partula*. The dentition proves it to be an *Achatinella*, being of the same type as *Achatinella* s. s., and *Partulina*.

Note on the Classification of the Achatellinæ.

BY THOMAS BLAND.

IN the paper by my friend Mr. W. G. Binney and myself, "On the Lingual Dentition and Anatomy of *Achatinella* and other Pulmonata" (Annals X, 1873), we adopted and gave particulars of the classification of v. Martens (Die Heliceen, ed. 2) and came to the following conclusion, viz., that three groups are indicated by the forms of lingual dentition in the genus *Achatinella*.

- a. *Partulina*, *Achatinella* s. str.
- b. *Newcombia*, *Laminella*.
- c. *Leptachatina*.

As regards the subgenera (of v. Martens) not represented among shells received from Mr. Gulick, we concluded, judging from the shell alone, that *Bulimella* and *Apex* belong to the group *a*, and *Labiella* rather to *b* or *c* than to *a*.

Considering the intimate acquaintance of my friend, Mr. Gulick, with the genus, and his publication of a classification of the *Achatellinæ* (Proc. Zool. Soc., 1873), it seems to me very desirable that his views should be compared with those of v. Martens, with especial reference to the results obtained from examination of the dentition.

In the foregoing paper by Binney, he expresses doubt as to the validity of our group *c*, and for my present purposes I therefore adopt two groups only, *a* and *b*, as indicated by the dentition of the species.

Gulick's classification is as follows :—

ACHATELLINÆ.

A. *Arboreal Genera.*

1. *Achatinella*, Swainson.

Type *A. vulpina*, Fér.

This is equivalent to the s. g. *Achatinella* s. str. of v. Martens.

2. *Bulimella*, Pfeiffer.

Type *B. rosea*, Sw.

This agrees with the s. g. *Bulimella* of v. Martens.

3. *Apex*, v. Martens.

Type *A. decora*, Fér.

This also agrees with the s. g. *Apex*, v. Mart.

4. *Laminella*, Pfeiffer.

Type *L. gravis*, Fér.

Laminella, Gulick, includes section *b* of *Newcombia*, v. Mart., but otherwise agrees with *Laminella* of that author.

5. *Partulina*, Pfeiffer.

Type *P. virgulata*, Mighels.

Gulick embraces in this s. gen. two sections, *Perdicella* and *Eburnella*, proposed by Pease, the type of the former placed in *Leptachatina* by v. Martens, of the latter in *Partulina*.

Partulina, Gulick, otherwise agrees with the same s. gen. of v. Martens.

6. *Newcombia*, Pfeiffer.

Type *N. Cumingi*, Newc.

Gulick, in a measure, agreeing with Pfeiffer, confines this s. gen. to the plicated species of section *a*. *Newcombia*, v. Mart. *A. picta* of that section is in *Laminella*, Gulick.

7. *Auriculella*, Pfeiffer.

Type *A. auricula*, Fér.

Gulick and Pfeiffer correctly treat *A. auricula*. That and other species of the s. gen. (Bland & Binney, l. c.) have the same denti-

tion as species of *Partulina* and *Achatinella*, by no means of *Partula* in which *A. auricula* is placed by v. Martens. Gulick adopts *Frickella*, Pfeiffer, as a section of this s. gen.

B. *Terrestrial Genera.*

8. *Carelia*, H. & A. Adams.

Type *C. adusta*, Gould.

V. Martens places *C. adusta* (as syn. of *bicolor*, Jay) in *Carelia*, s. gen. of *Achatina*. Pfeiffer includes species of *Carelia* in *Spiraxis*, C. B. Ad.

9. *Amastra*, H. & A. Adams.

Type *A. magna*, C. B. Ad.

This embraces species placed both in *Laminella* and *Leptachatina* by v. Martens. His type, *A. turritella*, Fér., of *Leptachatina*, is in *Amastra* of Gulick.

10. *Leptachatina*, Gould.

Type *L. acuminata*, Gould.

Gulick includes section *Labiella*, Pfr., treated by v. Mart. and Pfeiffer, as a separate s. genus.

In explanation of Gulick's views I add the following extract from a letter addressed to me by him, dated China, April 11, 1874.

"It appears from the teeth, that Pfeiffer was right in putting *Auriculella* with the *Achatellinæ*. I am sorry that when last in the Sandwich Islands, I did not succeed in getting any specimens of *Carelia* or *Newcombia* for examination. The latter is undoubtedly allied to *Partulina*, the former is more nearly allied to *Amastra*, but the form is so different, it would be very interesting to know about the teeth.*

Achatinella, *Bulimella* and *Apex* are evidently closely allied, but any classification which, like Pfeiffer's, recognizes the difference between the first two should also recognize the last, which is quite as distinct.

Achatinella and *Bulimella* are completely graded together by the varieties of *A. casta* and *A. oviformis*, Newc. and of *B. Sowerbyana*, Pfr.

Under the name *Laminella* I group only a few species, viz., *L. gravis*, *straminea* and *sanguinea* on Oahu, *citrina* and *venusta* on Molokai, *tetrao* on Lanai, *bulbosa* on E. Maui, and *picta* on W. Maui; these are all arboreal in their habits and sinistral in form, while the numerous species of *Amastra* are, with but rare exceptions, confined to the ground and dextral in form. *A. soror* and *A. acuta* are the only sinistral species that I now remember. Of most of the species, sinistral specimens have never been seen."

* I am disinclined to adopt the views of Pfeiffer and v. Martens, that *Carelia* belongs either to *Achatina* or *Spiraxis*.

The result of Binney's examination of the dentition of species of the genus *Achatinella*, as classified by Gulick, is as follows; group *a*, *Achatinella* s. str., *Bulimella*, *Apex*, *Partulina*, *Auriculella*, group *b*, *Laminella*, *Amastra*, *Leptachatina*. The subgenera of Gulick, of which the dentition is unknown, are *Newcombia* and *Carelia*.

It will be seen that the dentition of Gulick's arboreal s. genus *Laminella*, the species of which are said to be sinistral, is the same as of his terrestrial s. genera *Amastra* (the species with rare exceptions dextral) and *Leptachatina*.

V. Martens and Gulick place various species in different subgenera; this surely shows that the distinctions derived from consideration of shell alone are arbitrary, and the limits of the subgenera ill defined.

Pfeiffer, from form of shell alone (Mon. VI, 161), adopts the following names for the sections in which he arranges the species of *Achatinella*; the letters *a* and *b* indicate the group to which each section belongs from consideration of dentition.

<i>a</i> 1. <i>Partulina</i> .	<i>b</i> 6. <i>Laminella</i> .
<i>a</i> 2. <i>Bulimella</i> .	? 7. <i>Newcombia</i> , <i>a</i> .
<i>b</i> 3. <i>Labiella</i> .	<i>b</i> ? 8. " <i>b</i> .
<i>a</i> 4. <i>Achatinellastrum</i> .	<i>b</i> 9. <i>Leptachatina</i> .
(= <i>Achatinella</i> s. str.).	<i>a</i> ? 10. <i>Frickella</i> .
<i>b</i> 5. <i>Amastra</i> .	<i>a</i> 11. <i>Auriculella</i> .

EXPLANATION OF THE PLATES.

PLATE XII.

Genitalia of:—

- | | |
|---------------------------------------|---|
| FIG. | FIG. |
| 1. <i>Bulimulus pallidior</i> , Sowb. | 6. <i>Helix septemvolva</i> , Say. |
| 2. <i>Helix aspera</i> , Fér. | 7. <i>Ariolimax Hemphilli</i> . |
| 3. <i>Helix spinosa</i> , Lea. | 8. <i>Helix crispata</i> , Fér. |
| 4. <i>Limax montanus</i> , Ing. | 9. <i>Ariolimax Andersoni</i> , J. G. Coop. |
| 5. <i>Helix arrosa</i> , Gld. | |
-
- | | |
|-------------------------------|-----------------------|
| p. s. penis sac. | v. d. vas deferens. |
| v. p. vaginal prostate. | f. flagellum. |
| r. retractor muscle. | e. epididymis. |
| g. b. genital bladder. | ov. oviduct. |
| d. g. b. duct of same. | v. vagina. |
| a. d. accessory duct of same. | or. external orifice. |
| ov. ovary. | pr. prostate. |
| t. testicle. | |

PLATE XIII.

- FIG.
- A. Genitalia of *Helix ruficincta*, New.
d. s. Dart sac?
- B. *Zonites cerinoideus*, Anth. Central, lateral and marginal teeth of the lingual membrane.
- C. Genitalia of *Amphibulima Rawsonis*, Bl.
r. The retractor muscle of the penis sac.
- D. *Cæcilianella Gundlachi*, Pfr. Jaw.
- E. *Orthalicus undatus*, Brug. var.
Central, lateral and marginal teeth.
- F. Genitalia of *H. Jamaicensis*, Chemn.
e. The long epididymis.
- G. Same as D; enlarged still more to show the nature of the ribs.
- H. Central, lateral and marginal teeth of same.
- I. Same. Transition and marginal teeth.
- J. *Strophia incana*, Binn. Central, lateral, transition and marginal teeth.
- K. Same of *Helix Carpenteriana*, Bl.

PLATE XIV.

- FIG. Lingual Dentition of:—
- A. *Helix fringilla*, Pfr. See also pl. xv, fig. A.
- B. *Helix Jamaicensis*, Ch.
- C. *Helix Studeriana*, Fér.
- D. *Achatinella venusta*, Mighels.
- E. *Amphibulima Rawsonis*, Bl.
- F. *Glandina truncata*, Say.
Central and first-lateral tooth and part of the latter still more enlarged.
- G. Transition and marginal teeth of *Achatinella textilis*, Fér.
- H. An inner marginal tooth of *Achatinella obesa*, Newc.

PLATE XV.

FIG. Lingual dentition of:—

- A. *Helix fringilla*, Pfr. See also pl. xiv, fig. A.
- B. *Helix Carpenteri*, Newc.
- C. D. *Helix pubescens*, Pfr.
Jaw and teeth.
- E. *Patula Cumberlandiana*, Lea.
- F. *Cylindrella Poeyana*, Orb.
- G. *Helix Diabloensis*, J. G. Coop.?

PLATE XVI.

FIG. Jaw and lingual dentition of:—

- A. B. *Bulimulus limnæoides*, Fér.
- C. *Helix cereolus*, Muhl.
- D. E. *Helix exoleta*, Binney (see p. 178).
- F. *Helix rufescens*, Penn.
- G. *Helix dentiens*, Fér.
- H. *Trochomorpha Cressida*, Gld.
- I. *Nanina radians*, Pfr.

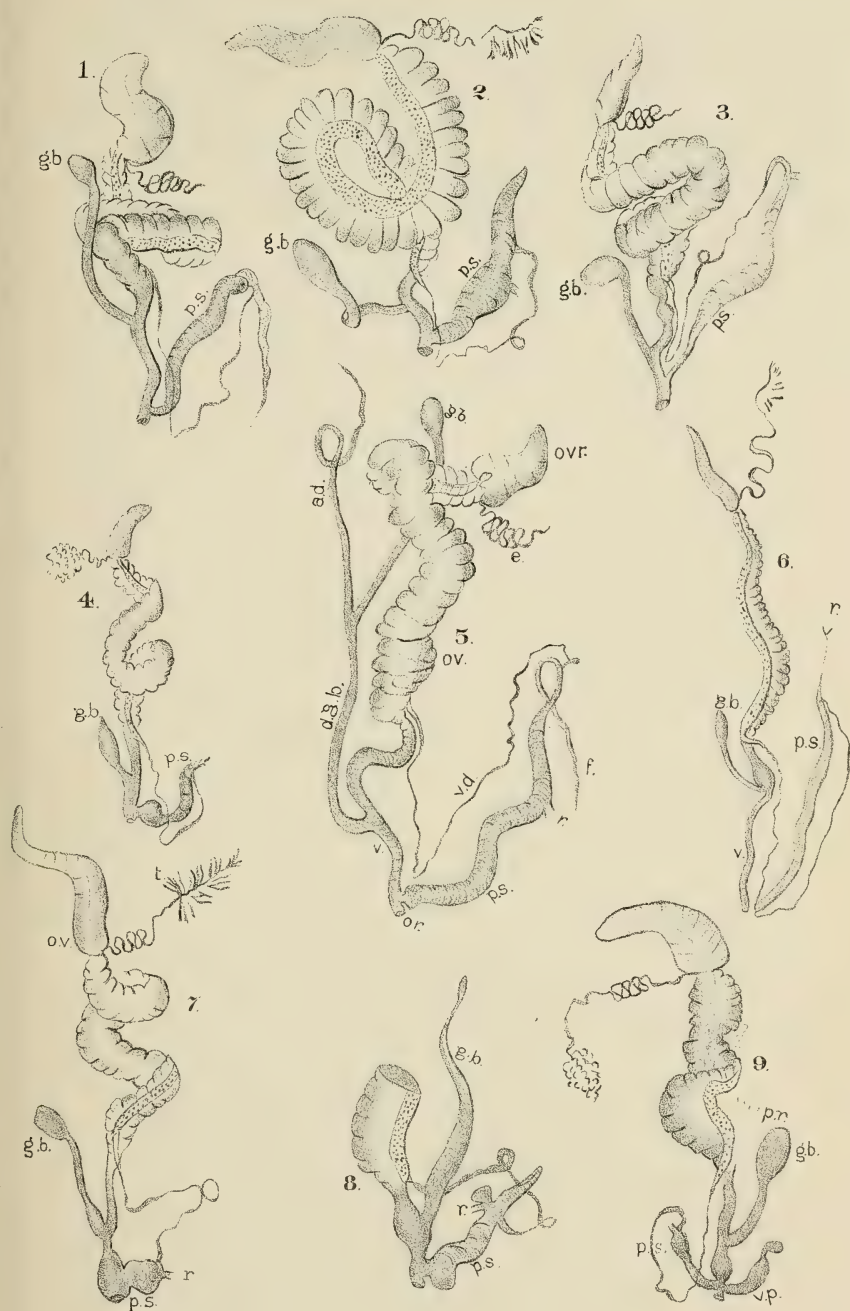
PLATE XVII.

- FIG. I. *Cylindrella ornata*, G. The central, first and last teeth.
- II-IV. *Binneya notabilis*. Jaw, animal in half repose, and the central, first, sixteenth and last teeth.
- V. *Helix Tryoni*, Newc. The central, first, eleventh, thirteenth, fourteenth, thirty-seventh and last teeth.
- VI. *Succinea papillata*, Pfr. Central, lateral and marginal.
- VII. *Succinea pallida*, Pfr. Central and first and fifteenth teeth.
- VIII. *Helix Van Nostrandii*, Bl. Central, first, tenth, eleventh, nineteenth and twenty-fourth teeth.
- IX. *Helix facta*, Newc. Genitalia.
- X. *Helix Tryoni*, Newc. Genitalia.
- XI. *Helix fallax*, Say. Genitalia.
- XII. *Helix Van Nostrandii*, Bl. Genitalia.
- XIII. *Helix facta*, Newc. Central, first, fourth, twelfth, thirteenth, seventeenth and twenty-sixth teeth.
- XIV. *Helix Hopetonensis*, Shuttl. Genitalia.
- XV. *Helix alternata*, Say, var. Genitalia.
- XVI. *Endodonta incerta*, Mouss. Central, first and last teeth.
- XVII. *Patula Huahinensis*, Pse. Central, lateral and marginal.
- XVIII. *Helix Rugeli*, Shuttl. Genitalia.
- XIX. *Helix tridentata*, Say. Genitalia.

PLATE XVIII.

FIG. Lingual dentition of:—

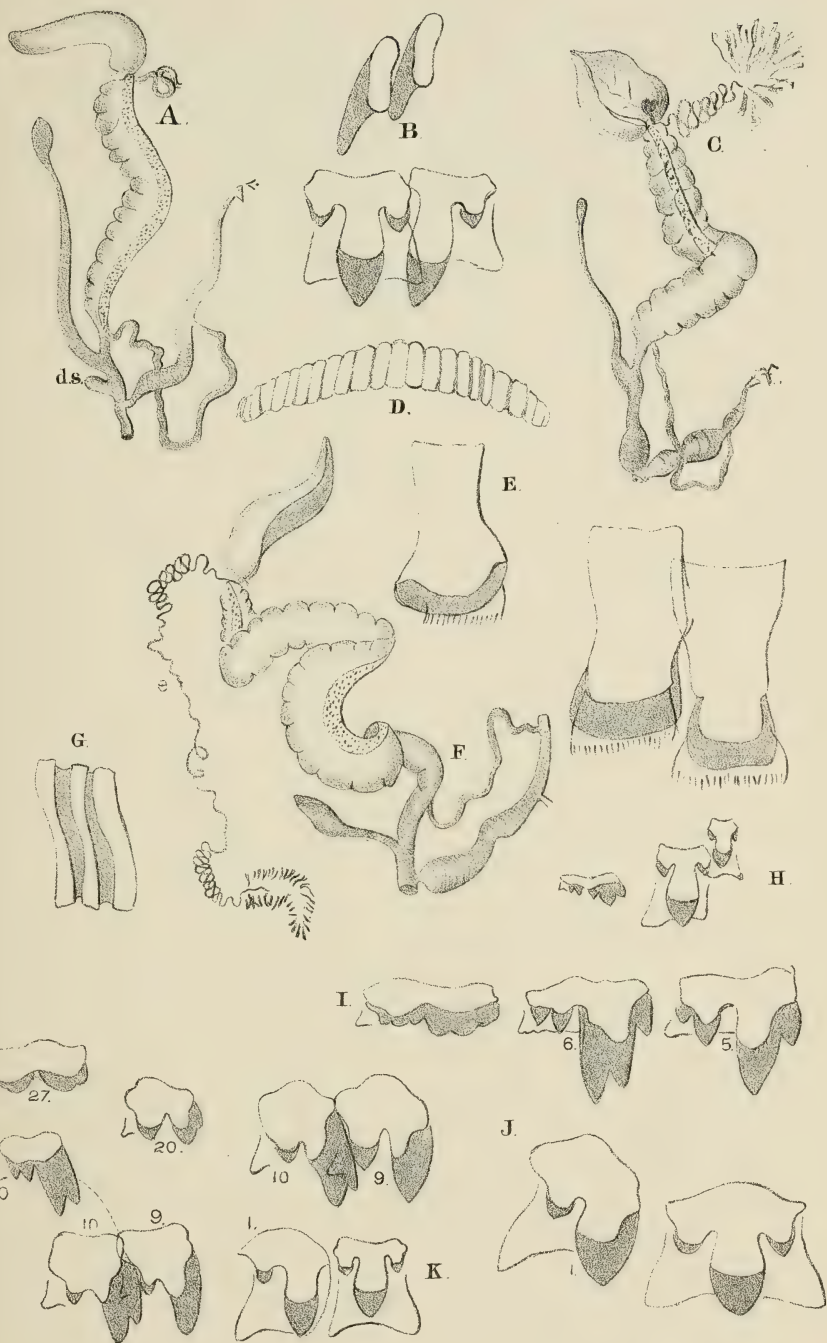
- A. *Helix Harfordiana*, J. G. Coop.
- B. *Helix leporina*, Gld.
The right hand figure shows an abnormal first latera..
- C. *Helix Ingersolli*, Bland.
- D. *Limax montanus*, Ing.
- E. *Helix auriculata*, Say.
- F. Var. *castaneus* of D.
- G. *Ariolimax Andersoni*, J. G. C.?
- H. *Ariolimax Hemphilli*.
- I. *Anadenus*.



WGB. del.

J.H. Bufford's Sons Lith. Boston

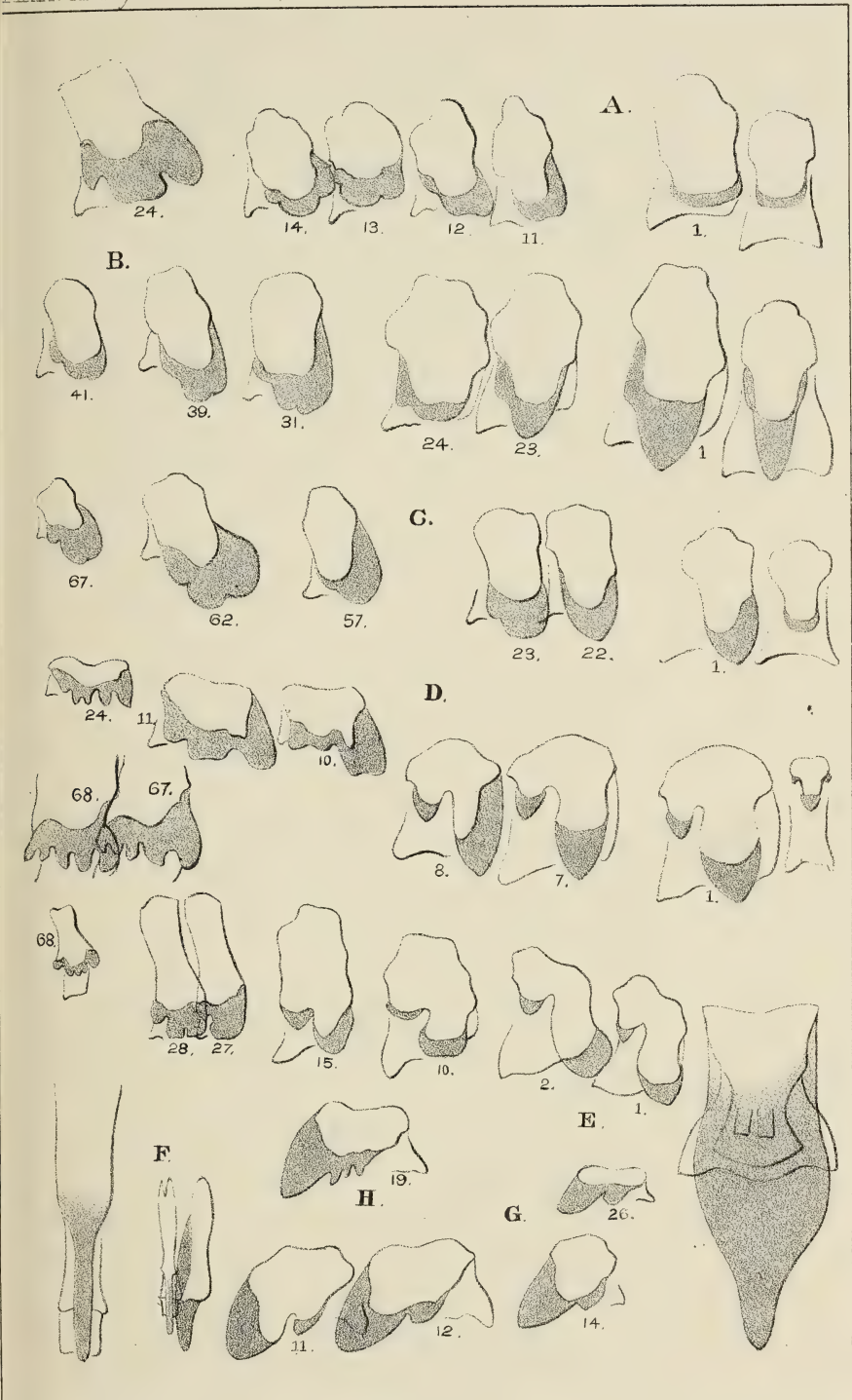
1. *Eupolindia* *Soy*2. *Hesperia* *Fer*3. *H. spinosa* *Zee*4. *H. longicauli*5. *H. hirsuta* *Gld*6. *H. sphaerulata* *S.*7. *Amel. Hemphilli*8. *H. crispata* *Fer*9. *A. Andersii* *W.C.*



WGB del.

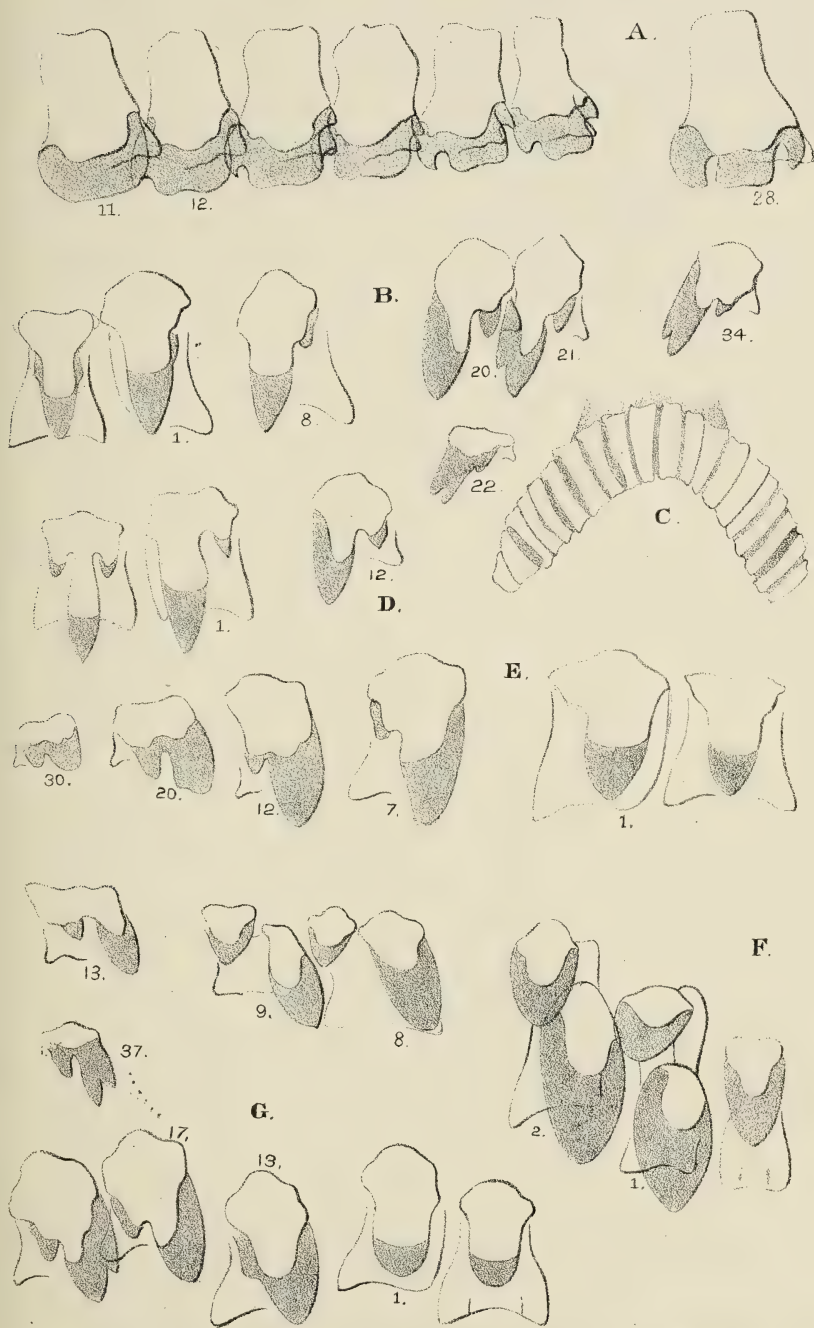
J.H. Buffords Sculp. Lith. & Print.

A. *Hrusicincta Newc.* B. *Z. cerinoideus Anth.* C. *Amphibulima Rawsonis El.*
 D. G. H. *Coecil Gundlachi Pf.* E. *Orthalicus undatus Brug var*
 F. H. *Jamaicensis Ch.* J. *Strophia incana Binn.* K. H. *Carpenteriana El.*



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A. *H. fringilla* P^c. B. *H. jamaicensis* Cherm. C. *H. studeriana* Fér.
D. *A. achillavenuusta* Migh. E. *A. rawsoni* Bl. F. *G. truncata* Say.
G. *A. achilla* textilis Fér. H. *A. obesa* Newc.



WGB. del.

J.H. Bufford's Sons Lith. Boston.

A. *H. fringilla* *Pfr*

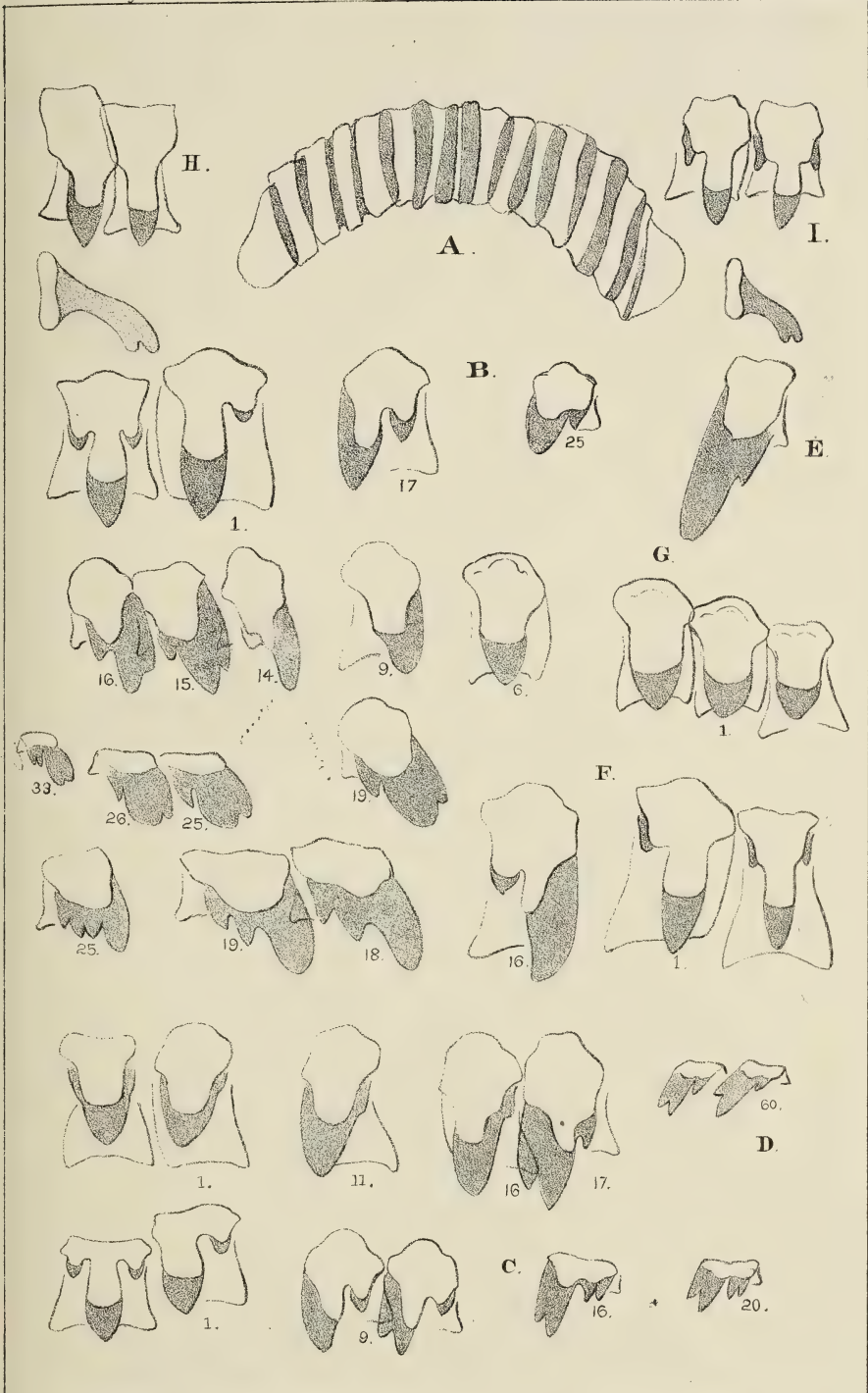
B. *H. Carpenteri* *Newc.*

C. *D. H. pubescens* *Pf*

E. *Pat. Cumberlandiana* *Lea.*

F. *Cyl. Poeyana* *Orb.*

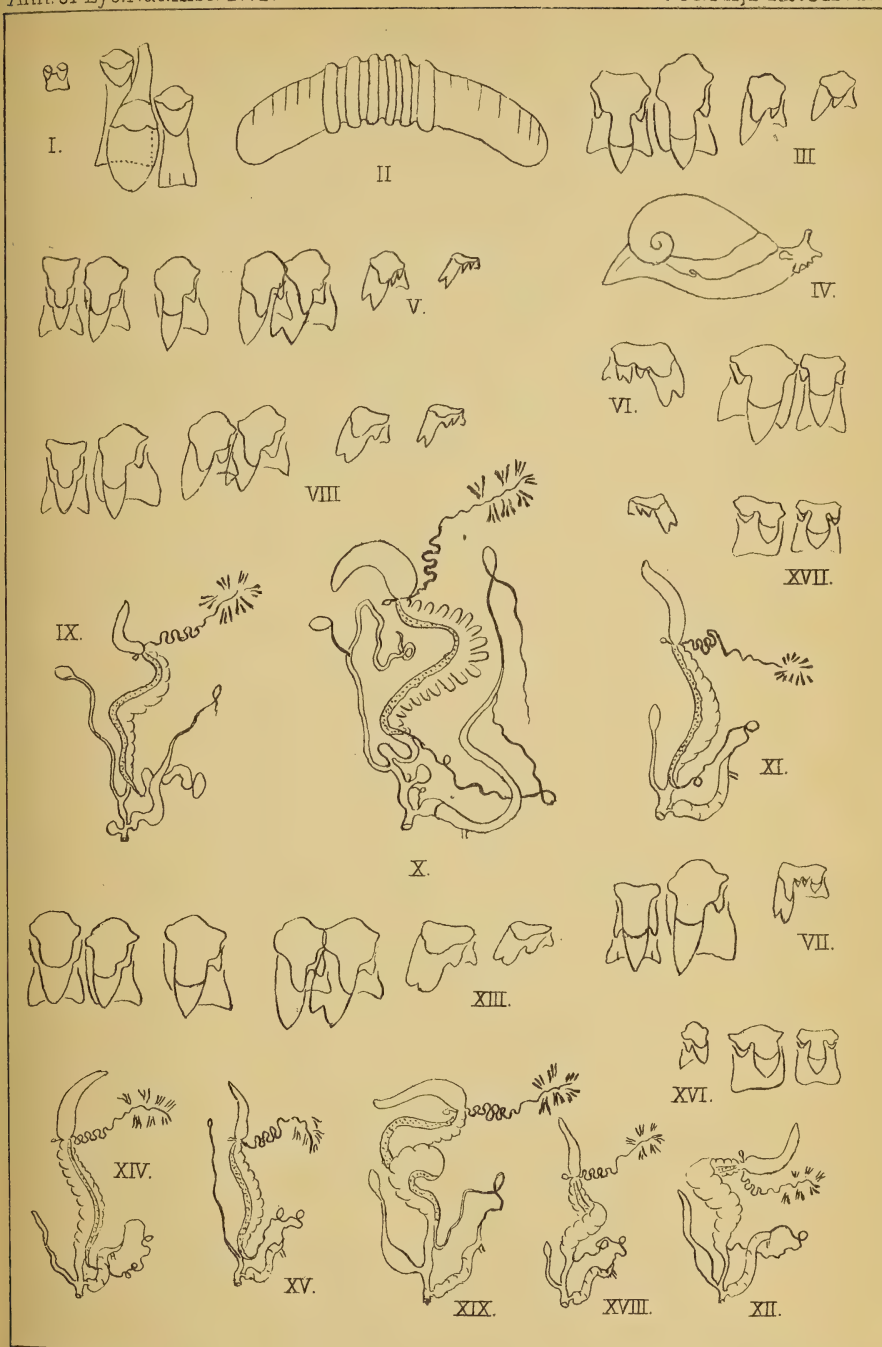
G. *H. Diabloensis* *Coop*



W.C.P. Del.

J.H. Bufford's Sons Lith. Boston

A. E. *Bulimnaecides* Fer. C. H. *cereolus* Mühlf.
 D. E. *Hexclera* Binn. F. H. *rufescens* Penn. G. H. *dentiens* Fer.
 H. *Trochom* Cressida. Gould. I. N. *radians* Pfr.



W.G.B. del.

PHOTO-LITHOGRAPH BY J. CARBUTT.
PHILADELPHIA.

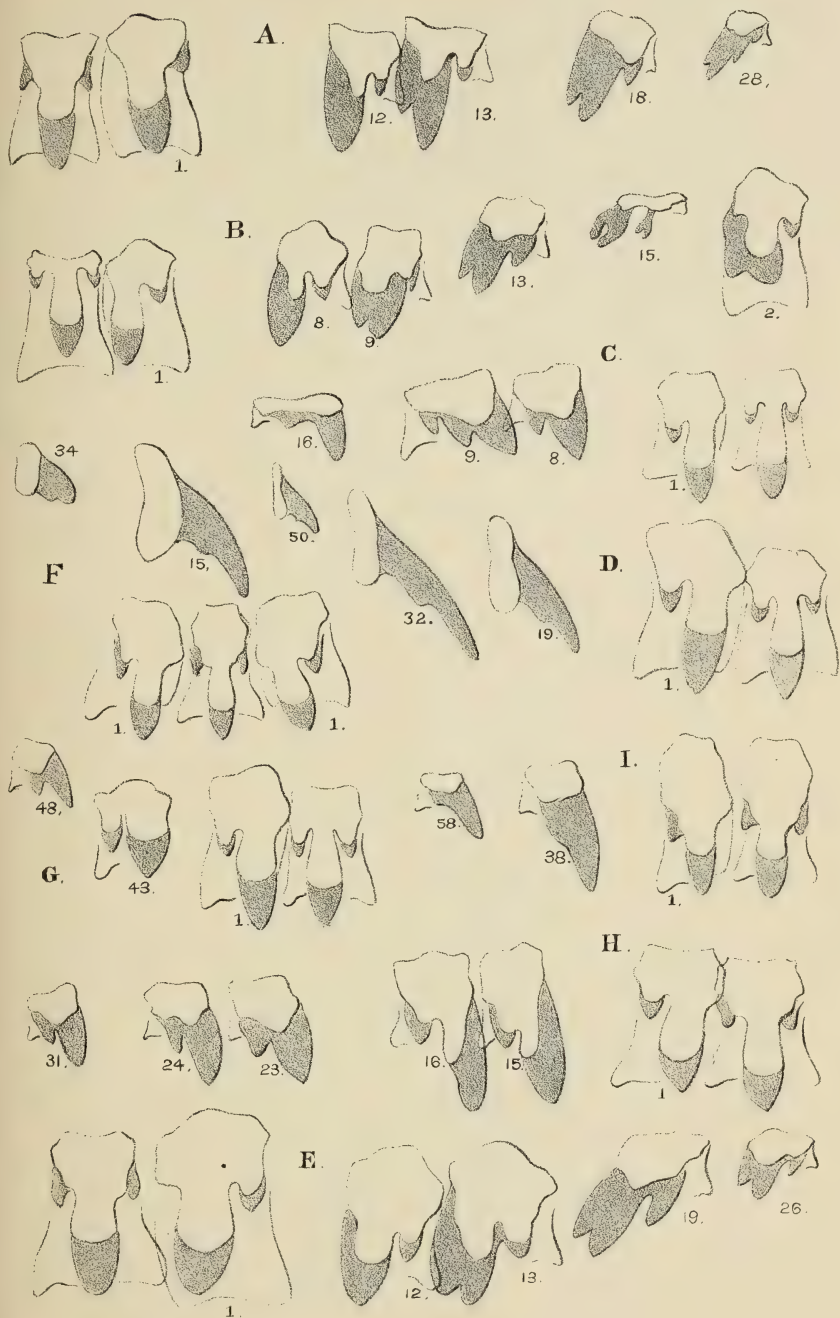
I. *Cyl. ornata*, G.
II-IV. *Binneia notabilis*.
V. *X. H. Tryoni*, N.
VI. *S. papillata*, Pfr.

VII. *S. pallida*, Pfr.
VIII. XII. *H. Van Nostrandii*, Bl.
IX. XIII. *H. facta*, Newc.
XI. *H. fallax*, Say.

XIV. *H. Hopetonensis*, Sh.
XV. *Pat. alternata*, S.
XVI. *End. incerta*, M.
XVII. *P. Huahinensis*, Pse.

XVIII. *H. Rugeli*, Sh.

XIX. *H. tridentata*, S.



WGB. del.

J.H. Bufford's Sons Lith. Boston.

- | | | |
|--------------------------------|-----------------------------|-----------------------------|
| A. <i>H. Harfordiana</i> JGC | B. <i>H. leporina</i> G | C. <i>H.ingersollii</i> ZW |
| D. <i>Limax montanus</i> | E. <i>H. auriculata</i> Say | F. <i>Limax castaneus</i> Z |
| G. <i>Ariol. Andersoni</i> JGC | H. <i>A. Hemphilli</i> | I. <i>Anadenus</i> |

[Extracted from the Proceedings of the Academy of Natural Sciences of Philadelphia,
September 26, 1876.]

ON THE LINGUAL DENTITION, JAW, AND GENITALIA OF CARELIA,
ONCHIDELLA, AND OTHER PULMONATA.

BY W. G. BINNEY.

Macrocyelis sportella, Gld.

Oregon. Mr. O. B. Johnson.

Jaw and lingual membrane as usual in the genus. (See Proc. Acad. Nat. Sci. Phila., 1875.)

Teeth 22—1—22. The 6th tooth is the largest. The peculiar side spur noticed on the inner laterals of *Macr. Vancouverensis* is present in this species also. The central tooth is of same type as that of the last-named species, to which *sportella* is most nearly allied by its shell. Pl. VI., fig. AA.

Zonites inornatus, Say.

Pl. VI., fig. c, represents the dentition of this species, showing both planes of the cusps and cutting points. The dotted lines show the lower plane, *i. e.*, the part which rests on the base of attachment. This is what I have hitherto shown in my plates. From this lower plane the cusp and cutting point bulge out laterally as they round upwards. The most outward margin is the other plane shown, giving the widest extension of the cutting point.

Zonites fuliginosus, Griff.

On pl. VI., fig. d, is a lateral tooth of this species showing the two planes described under *Z. inornatus*.

Zonites(?) Bermudensis, Pfr.

Bermuda. Mr. J. Matthew Jones to Mr. Bland.

The specimens were living, enabling me to study advantageously the external characters of the animal. There is a distinct locomotive disk to the foot, but no caudal mucus pore, and no longitudinal furrows above the margin of the foot, so that the species cannot be placed in *Zonites*, which has the last two characters. The external orifice of generation is quite under the mantle, not behind the right eye-peduncle.

The jaw and dentition I have already described. (Ann. Lyc. Nat. Hist. of N. Y., X., 221.)

The genitalia present the following peculiarities. The genital bladder is small, globular, on a long duct. The penis sac is long,

tapering to its apex, where it receives the vas deferens and the retractor muscle. There is a long, stout, dart sac, containing a delicate, arrow-like dart of the same form as figured by Leidy for *Zonites ligerus* (Terr. Moll., U. S. I.).

The absence of the caudal mucuspore removes the species from *Zonites*, nor can it be placed in any recognized genus.

Limax Hewstoni, J. G. Coop.

California. Dr. Cooper.

Pl. VI., fig. F, represents the genitalia of this species, which I have recently drawn from specimens kindly furnished by Dr. Cooper. For description, see Ann. Lyc. Nat. Hist. of N. Y., XI., p. 22.

Limax campestris, Binney, var. *occidentalis*.

California. Dr. J. G. Cooper. (See Proc. Acad. Nat. Sci. of Phila., 1872, 146, pl. III., fig. c.)

In outward appearance, in genitalia and in jaw, this form cannot be distinguished from the eastern form. Its lingual membrane has 35—1—35 teeth, 13 being laterals. On some of both the inner and outer marginals I can detect the side spur which in the eastern form I have only observed in the outer marginals. In this particular, *occidentalis* is more nearly allied to *L. montanus*, Ingersoll,¹ but when the value of differences in such slight details becomes known, I believe all three species will be found identical.

Pl. VI., fig. x, b, gives two inner marginals.

Onchidella borealis, Dall.

Alaska. Dr. W. H. Dall.

In three specimens examined I found a jaw (pl. VI., fig. BB), low, wide, slightly arcuate, ends scarcely attenuated, blunt, anterior surface ribless.

Lingual membrane (pl. VI., fig. EE) long and wide. Teeth about 61—1—61, arranged strongly en chevron. The central tooth is large, longer than wide, truncated above, expanded below its middle, and incurved at the basal margin. The reflection is large, tricuspid, each cusp bearing a decided cutting point. The side teeth have a long, narrow base of attachment, a small portion of its upper portion thrown outwards, the balance curving inwards, giving an irregular bow-shape to the whole base of attachment—

¹ This is the species indicated by me as *L. Ingersolli*, in Proc. Acad. Nat. Sci. Phila., 1875, 176.

whose upper and lower edges are abruptly truncated. The reflection is near the base, and consists of a very small, inner cusp, bearing a small conical cutting point, and another, outer, larger cusp, bearing an extraordinarily developed, wide, expanding, bluntly truncated cutting point. As the teeth pass outwards towards the outer margin of the membrane, they at first increase and then decrease in size, but retain the same shape quite to the edge.

An outer lateral tooth is figured in *c*, an inner lateral in *b*.

Fig. E, of plate VI., gives a view of the lower surface of the animal and also one of the head, showing the short, stout eye peduncles and curious oral appendages.

The *Onchidiidæ* are described as agnathous, but I am confident of having observed the jaw figured.

Ariolimax Columbianus, Gld.

From Mr. O. B. Johnson, of Forest Grove, Oregon, I have received specimens of this species. On examining the genitalia, I find them to agree perfectly with what I have already figured in Proc. Acad. Nat. Sci. of Phila., 1874, pl. XI., fig. c. I am convinced, therefore, of the identity of the specimens there figured, of which some doubt then existed.

Binneya notabilis, W. G. B.

Sta. Barbara Island, California, Mr. Henry Hemphill.

Pl. VI., fig. v, represents almost the whole of the genital system. The penis sac is long, narrow, tapering at its apex, where it receives the vas deferens: the retractor muscle is inserted below the entrance of the latter. The genital bladder is oval, on a long, narrow duct. There is a small, saclike, accessory organ, probably a dart sac.

Carelia bicolor, Jay.

Dr. W. H. Dall.

Through the kindness of Dr. Dall, I have been able to examine this species, formerly known as *Achatina bicolor*. Thus I have increased the list of subgenera or groups of *Achatinella* of Gulick's arrangement, whose jaw and lingual dentition is known, leaving still to be examined *Newcombia* only of the same arrangement.

It will be seen from my description, that while *Carelia* (or at least this species) differs utterly in jaw and dentition from Gulick's *Achatinella* s. s., *Bulimella*, *Apex*, *Partulina*, *Auriculella*, it agrees

in dentition with his *Laminella*, *Amastra*, *Leptachatina*, but differs in having a costate jaw. *Carelia*, therefore, must stand distinct from any of the other groups of *Achatinella*.

My description and figures should be studied in connection with my former papers on *Achatinella* in *Annals of Lyceum of Natural History of New York*, Vol. X., p. 331, pl. xv., and Vol. XI., p. 190, pl. xiv., in the preparation of which I was assisted by Mr. Bland.

The animal is obtuse before, pointed behind. The mantle appears subcentral in the single individual examined, which is preserved in alcohol. The orifice of respiration and anal orifice are as usual in the heliciform genera. The genital orifice as far as I can judge is somewhat removed from behind the right eye peduncle, rather under the mantle edge, but it is difficult to say what is its position in the living animal. There is no sign of a distinct locomotive disk or of a caudal mucus pore.

The jaw (pl. VI., fig. g) is low, slightly arcuate, with but little attenuated, blunt ends: anterior surface with ten stout ribs, denticulating either margin.

Lingual membrane (pl. VI., fig. cc) long and narrow. Teeth 37—1—37 of same type as I have formerly described (l. c.) for species of *Laminella*, *Amastra*, and *Leptachatina*, the marginals being irregularly and obliquely pectinate as in *Achlla. obesa* (l. c.).

The digestive system, as would be anticipated from the shape of the shell, is characterized by the extreme length of the œsophagus. The salivary ducts are comparatively short. The salivary glands are small and in a globular mass around the œsophagus. The buccal mass with its pouch of the lingual membrane is as usual: its retractor muscle is attached to the retractor of the head.

The genitalia are here figured (pl. VI., fig. o). It will be seen that there is in the specimen examined a decided external swelling of both male and female (the former, female (*f. o.*), large and horn-shaped, the latter, male (*m. o.*), small and globular) organs; owing, perhaps, to the sudden immersion of the individuals in alcohol. The gravid state of the uterus precludes the possibility of these swellings being preparatory to accouplement. This condition of the external orifices accounts for the wide separation of the genital bladder from the vagina, and of the accessory organ (*pr.*) from the penis sac. The figure is of life size, all the organs having been accurately measured. The testicle (*t.*) is composed of short cœca grouped in a globular mass. The epididymis (*ep.*) is short and

greatly convoluted. The ovary (*o.*) is obtusely tongue-shaped and lobate. The oviduct is sacciform and contained two well-developed embryonic shells, showing the species to be viviparous, as well as four masses, probably consisting of less mature embryos. The genital bladder is small, suboval, on a short duct. The penis sac (*p. s.*) is long, cylindrical, with a developed, extended median constriction. The vas deferens (*v. d.*) enters the apex of the penis sac: the retractor muscle (*r. p.*) of the penis is inserted just above the entrance. There is a long, narrow, accessory organ (*pr.*) with an extended median constriction to the penis sac, perhaps a dart sac or prostate gland. There is a stout retractor muscle (*r.*) to the external horn-shaped swelling of the male orifice.

***Microphysa incrustata*, Poey.**

Corpus Christi, Texas. A dried specimen collected over thirty years ago by Mr. Bartlett.

Jaw low, wide, slightly arcuate, ends blunt, but little attenuated: anterior surface with numerous, crowded ribs, bluntly denticulating the lower margin.

Lingual membrane (pl. VI., fig. *t*) with 13—1—13 teeth, 5 perfect laterals. The teeth are of same type as in other species of *Microphysa*, as *Ingersolli* (Ann. Lyc. of N. H. of N. Y., XI., pl. xviii., fig. *c*). The jaw also resembles that of *Microphysa* rather than *Patula*, to which I formerly referred the species. Von Martens places it in *Microphysa*. Fig. *b* shows marginal teeth.

***Triodopsis inflecta*, Say.**

Indiana. Mr. F. Stein.

Genitalia as in *T. Rugeli*. See Ann. Lyc. Nat. Hist. of N. Y., XI., pl. xvi., fig. 18.

***Turricula tuberculosa*, Conr.**

Palestine. A dried specimen in Mr. Bland's collection.

Lingual membrane (pl. VI., fig. *j*) long and narrow. Teeth 28—1—28. Centrals and laterals without decided side cusps or cutting points, but the central cutting point has a decided lateral bulge. Marginals low, wide, with one inner, oblique, large bifid cutting point, and two outer smaller cutting points. A marginal is shown in *f*.

Jaw with numerous, crowded, broad, flat ribs, denticulating either margin.

Helix monodon, Rackett.

Indiana. Mr. F. Stein.

Genitalia (pl. VI., fig. q) characterized especially by a very unproportionally large penis sac, which is long, club-shaped, greatly enlarged above, where it receives the vas deferens and retractor muscle. The genital bladder is elongate-oval, small, on a short, delicate duct. The epididymis is convoluted throughout its length.

Polygyra Postelliana, Bland.

Charleston, S. C. Mr. W. G. Mazyck.

Genitalia as in *P. auriculata*. (See Leidy in Binney's Terr. Moll. U. S. I.)

Jaw as usual in the genus: over 12 ribs. Lingual membrane (pl. VI., fig. z) as in *P. Hazardi*. (See Proc. Acad. Nat. Sci. Phila., 1875, pl. viii., fig. 5.) The change from laterals to marginals is very gradual, and formed without the splitting of the inner cutting point. There are 21—1—21 teeth with about 7 laterals. Extreme marginals are shown in *b*.

Polygyra Dorfeuilleana, Lea.

A dried specimen long preserved in my cabinet furnished the lingual membrane here described.

Teeth (pl. VI., fig. v) 20—1—20, with 9 laterals, the tenth tooth having its inner cutting point bifid. Base of attachment subequilateral of central and lateral teeth. All the teeth of same type as in *P. auriculata*. (See Ann. Lyc. of Nat. of N. Y., XI., pl. xviii., fig. E.)

Polygyra avara, Say.

Banks of St. John's River, Florida. Mr. Chas. Dury.

It is with peculiar satisfaction that I give these details, as it is one of our rarest species.

Jaw as usual in the genus, with over 12 ribs. (See Proc. Acad. Nat. Sci. Phila., 1875, p. 201.)

Lingual membrane as usual in the genus (see same, p. 202). The change from laterals into marginals is shown in the 9th tooth, which is the first having a bifid inner cutting point. There are 17—1—17 teeth. Pl. VI., fig. y.

Caracolus sagemon, Beck.

Gonave Island. Prof. Linden to Mr. Bland.

On pl. B, fig. gg, I figure the dentition of the specimens described in full by Mr. Bland in Ann. Lyc. Nat. Hist. of N. Y., XI., 197 (1875).

Mesodon major, Binn.

This species (or form of *albolabris*) was found by me near Aiken, S. C., but still larger specimens, at Macon, Ga., in the City Cemetery, by Mr. H. S. Crooke. The form seems to inhabit a narrow strip of territory east of the mountains from Abbeville, S. C., to the Gulf of Mexico. The largest specimen I have ever seen is 48 mill. in its greater diameter.

The jaw, lingual dentition, and genitalia agree with those of *albolabris*. Fig. I, of plate VI., represents the genital system of one individual examined, in which the ovary is very small, and the genital bladder unequally divided, both points differing from those of other individuals examined. This shows us we should allow some latitude of variation in the details of the genital system of any given species.

Aglaja fidelis, Gray.

Oregon. Mr. O. B. Johnson.

On pl. VI., fig. p, I give a more satisfactory figure of the genitalia of this species than formerly published by me. The organ *x* in the specimens recently examined was greatly developed. The organ is a dart sac, which contained a dart of the type described below under *Arionta Mormonum*.

Arionta Mormonum, Pfr.

Tulumne Co., California. Mr. A. W. Crawford.

Pl. VI., fig. s, represents the genitalia. The general appearance is that of *A. fidelis*, as formerly described by me (see below), but there is an additional accessory organ (*q.*), of use unknown to me. The organ, *r*, is a dart sac. The dart is short, stout, straight, swollen at its base, and with an enlarged acutely pointed apex (pl. VI., fig. k). Upon the vagina, above the insertion of the penis sac, is a ridge-like process (*s.*) containing in three individuals examined one round, and one oblong calcareous nodule (pl. VI., fig. j). I suspect the organ 14, noticed in *fidelis* (Proc. Acad. Nat. Sci. Phila., 1873, pl. I., fig. 5) corresponds with this process.

Jaw as usual in *Arionta*: 7 ribs.

Lingual membrane (pl. VI., fig. b) as usual in *Arionta*. Teeth 50—1—50, with 15 laterals, the 16th tooth having its inner cutting point bifid.

Arionta sequoicola, J. G. Coop.

Santa Cruz, California. Mr. H. Hemphill.

The genital system (pl. VI., fig. r) is like that of *Arionta Traski*.

(See Ann. Lyc. of Nat. Hist. of N. Y., XI., pl. VI., fig. iv.) The accessory bulb upon the vaginal prostate is somewhat differently situated in this species. The extreme length of the genital system is eighty-seven millimetres.

Jaw and lingual membrane already described. (See Proc. Acad. Nat. Sci. Phila., 1874, pl. XIV., fig. 5.)

Arionta Californiensis, Lea.

Monterey. Mr. H. Hemphill.

Jaw already described.

Lingual membrane with 53—1—53. Teeth as usual in the genus (see above). The side cusp and cutting point appears on the 9th tooth. The inner cutting point of the 25th is bifid, so that there are about 24 laterals (pl. VI., fig. w).

The genitalia are as in *A. Nickliniana* already described.

Arionta Dupetithouarsi, Desh.

Monterey. Mr. H. Hemphill.

Jaw as usual in the genus, with four, separated, stout ribs.

Lingual membrane with 50—1—50 teeth. There are no distinct side cusps or cutting points on the centrals or first laterals, though there is a lateral bulge on the large cutting point. The distinct side cusp and cutting point appears on the ninth tooth. There are about nineteen laterals, the twentieth tooth having its inner cutting point bifid. The marginals are as usual in the genus (pl. VI., fig. v).

Genitalia as in *A. Traski* (l. c.). The penis sac is more slender and has no retractor muscle in the single individual examined by me. The oviduct is greatly convoluted.

Glyptostoma Newberryanum, W. G. B.

San Diego, Cal. Henry Hemphill.

Genitalia (pl. VI., fig. H). *x* is a dart sac or prostate gland.

Bulimulus Dormani, W. G. B.

Port Orange, Florida. Mr. Chas. Dury.

Jaw (pl. VI., fig. M, the central portion only) as usual in the genus, arcuate, thin, transparent, ends acuminate, anterior surface with about 54 plait-like ribs. The figure gives only a portion of the jaw. The upper median ribs are very oblique.

Lingual membrane as in *B. laticinctus*, *primularis*, *papyraceus*, etc. Teeth 79—1—79. Pl. VI., fig. HH. This is the first species of

Bulimulus noticed within the United States having this peculiar type of dentition.

Genitalia figured on pl. VI., fig. N. Penis sac very long and narrow, ending in a flagellum: vas deferens entering at about the anterior fourth of its length. Genital bladder oval, on a long, narrow duct. No accessory organs.

Bulimulus Edwardsi, Mor.

Lake Titicaca. Prof. Alex. Agassiz.

Jaw low, arcuate, ends rapidly acuminate, blunt: anterior surface with over ten distant ribs, some of the usual *Helix* type, others like the plait-like processes, common in *Cylindrella*, *Bulimulus*, *Gæotis*, *Amphibulima*, etc.

Lingual membrane (pl. VI., fig. DD) with 44—1—44 teeth. Centrals of the usual *Helicinæ* type, tricuspid: laterals like centrals, unsymmetrical, and consequently bicuspid. The change to marginals very gradual, and formed by the simple modification of the laterals, without any splitting of the inner cutting point.

Succinea ovalis, Gould, not Say.

Burlington, New Jersey.

Teeth over 60—1—60. Fig. *b* represents extreme marginals (pl. VI., fig. A).

Jaw with smooth anterior surface and prominent median projection to the cutting edge.

EXPLANATION OF PLATE VI.

- Fig. A. Lingual dentition of *Succinea ovalis*.
 Fig. B. " " *Arionta Mormonum*.
 Fig. C. " " *Zonites inornatus*.
 Fig. D. " " " *fuliginosus*.
 Fig. E. *Onchidella borealis*.
 Fig. F. Genitalia of *Limax Hewstoni*.
 Fig. G. Jaw of *Carelia bicolor*.
 Fig. H. Genitalia of *Glyptostoma Newberryanum*.
 Fig. I. " *Mesodon major*.
 Fig. J. Lingual dentition of *Turricula tuberculosa*.
 Fig. K. Dart of B.
 Fig. L. Calcareous concretions of B.
 Fig. M. Jaw of *Bulimulus Dormani*, central portion.

Fig. N. Genitalia of M.

Fig. O. " Carelia bicolor.

t. Testicle.

ep. Epididymis.

o. Ovary.

ovid. Oviduct.

g. b. Genital bladder.

p. s. Penis sac.

r. p. Retractor penis.

r. Retractor.

pr. Prostate gland?.

v. d. Vas deferens.

m. o. Male orifice.

f. o. Female orifice.

e. t. External tegument.

Fig. P. Genitalia of Aglaja fidelis.

Fig. Q. " Stenotrema monodon.

Fig. R. " Arionta sequoicola.

Fig. S. " B.

Fig. T. Lingual dentition of Microphysa incrustata.

b. Marginals.

Fig. U. Lingual dentition of Arionta Dupetithouarsi.

Fig. V. Genitalia of Binneya notabilis.

Fig. W. " Arionta Californiensis.

Fig. X. " Limax occidentalis.

b. Inner marginals.

Fig. Y. Lingual dentition of Polygyra avara.

Fig. Z. " " " Postelliana.

Fig. AA. " " Macrocyclus sportella.

Fig. BB. Jaw of E.

Fig. CC. Lingual dentition of G.

Fig. DD. " " Bulimulus Edwardsi.

Fig. EE. " " E.

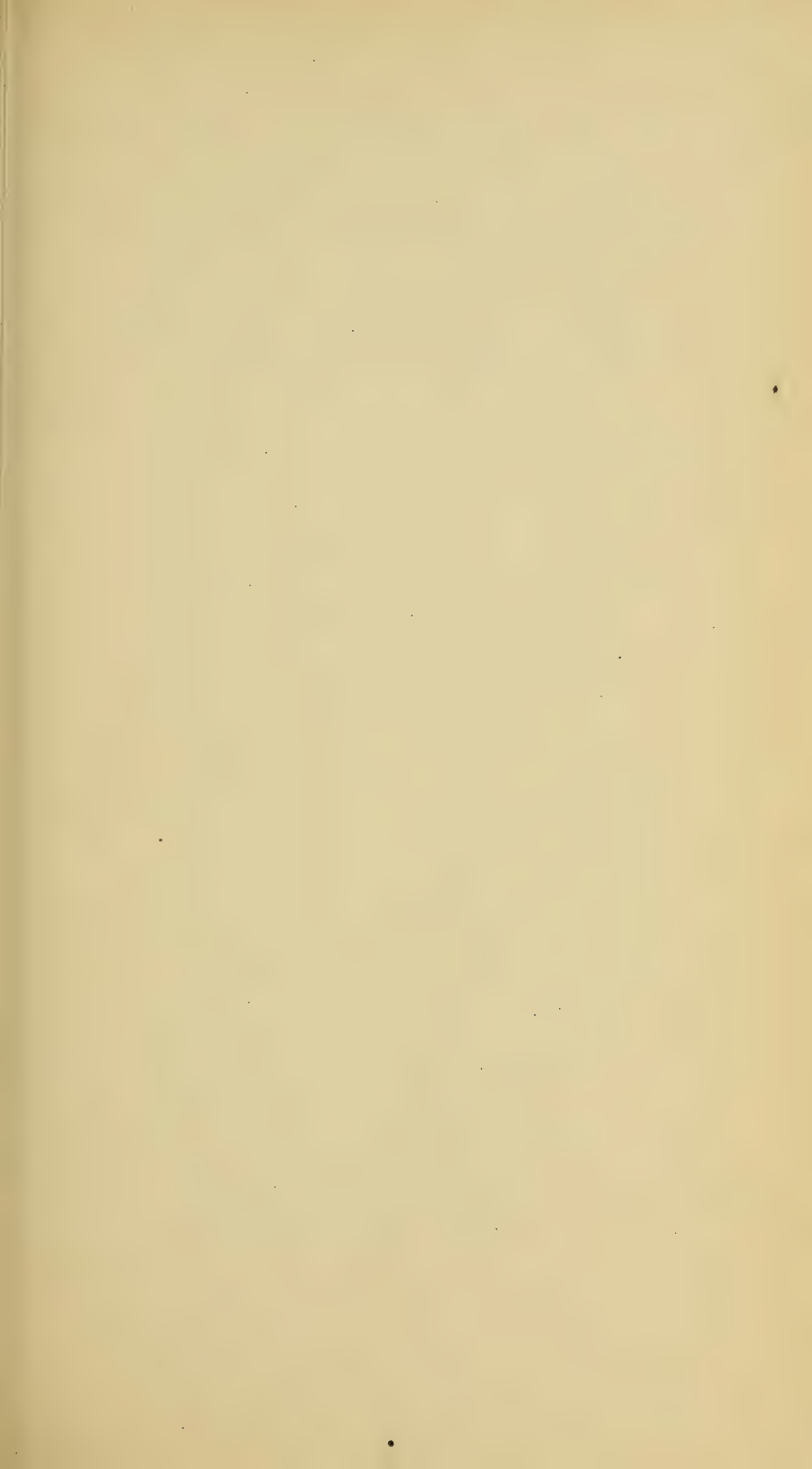
b. Inner marginals.

c. Outer marginals.

Fig. FF. Lingual dentition of Polygyra Derfeuilleana.

Fig. GG. " " Caraculus sagemon.

Fig. HH. " " M.



ON THE LAND SHELLS OF THE MEXICAN ISLAND OF GUADELUPE,
COLLECTED BY DR. E. PALMER.

BY W. G. BINNEY.

The island of Guadalupe is about 220 miles from San Diego, off the west coast of Lower California. Its molluscan fauna has for the first time been made known by the researches of Dr. Edward Palmer, who visited it in 1875. He found numerous fragments of snail shells which had been devoured by a species of mouse, the only inhabitant of the island. These fragments appear to belong to *Arionta Rowelli*, Newcomb (see L. & F. W. Sh. of N. A. I. p. 185), a species found in Lower California. Some perfect shells were found, among them a smaller variety. *Arionta facta*, Newcomb, was also found, the variety with open umbilicus, like that form found fossil on San Nicolas Island, California.

The most interesting discovery, however, is that of living specimens of *Binneya notabilis*, a species found also on the California island of Santa Barbara. There is strong reason for believing the Mexican genus *Xanthonyx* to be synonymous with *Binneya*. We may suppose, therefore, that from Mexico the genus has been introduced by the usual means of distribution to this island of Guadalupe, and thence to Santa Barbara. Thus, its presence on the latter island is accounted for, which was not the case when we had only the mainland of California to look to, as its absence there has been proved. So, also, in the case of *Arionta facta*, we may account for its distribution by supposing it to have been introduced from some unknown locality on the mainland to Guadalupe first, and thence to the California islands.

The specimens collected are in the Museum of the Boston Society of Natural History.

Four species of Orthoptera were collected also. One of these is shown by Dr. Scudder to be identical with a Mexican species, and two of the others have also been found at San Diego.

XXIII.—*On the Jaw and Lingual Dentition of certain Costa Rica Land Shells collected by DR. WILLIAM M. GABB.*

BY W. G. BINNEY.

(WITH PLATE XI.)

Read December 23d. 1878.

Among the specimens of land shells collected in Costa Rica by the lamented Dr. Gabb, were several preserved in spirits. These were submitted to me by him. I have examined the jaw and lingual dentition, and here offer the results of my examination. The original figures of the living animals, as drawn by Dr. Gabb, are also given, and his notes incorporated in the text. It will be seen that Dr. Gabb discovered two new genera.

*Velifera**, n. g.

Animal † (pl. xi, fig. A), heliciform, blunt before, tapering behind; mantle subcentral, thin, furnished with one or more ‡ accessory processes which cover most of the shell: respiratory, anal, and generative orifices,—?; a distinct locomotive disk: longitudinal furrows above the margin of the foot, meeting over a simple, longitudinal mucus-pore (pl. xi, fig. D.)

Shell (pl. xi, fig. B) imperforate, globose, very thin, polished; whorls few the last very large, scarcely falling at the aperture: aperture slightly oblique, large: peristome acute.

Jaw with smooth anterior surface and beak-like projection to the cutting edge.

Lingual membrane (pl. xi, fig. C) with the general arrangement of *Zonites*: the first laterals have an inner side cutting point: marginals aculeate, with side spur.

Although this animal does not combine the characters of any described genus, it is related to several by its separate characters. It has the caudal mucus-pore, and the jaw, of *Zonites*; but differs in having an appendiculate mantle. In

* Velum, a covering, a veil; fero.

† Animal heliciforme, antice obtusum, postice attenuatum, pallium tenue, subcentrale, appendiculatum, testam velans; apertura respiratoria, analis, et genitalis,—?; discus gressorius distinctus; porus mucosus caudalis.

Testa imperforata, globosa, tenuis, nitens, paucispira, anfr. ultimus globosus; peristoma acutum.

‡ As Dr. Gabb's figure gives the left of the animal, it is impossible to describe these processes correctly,

the latter character it also differs from *Vitrinoconus*. It has the shell, and probably, the appendiculate mantle, of *Helicarion*; but that genus has a horn-shaped process over its caudal pore.

Its lingual membrane resembles that of *Limax agrestis* in having the inner, abnormal side cutting point to its first lateral teeth. All the marginals are bifid.

For geographical distribution see below, under *V. Gabbi*.

Velifera Gabbi, n. sp.

Animal (pl. xi, fig. A) blunt before, tapering behind: greenish, with a continuous black band above the margin of the foot, and a second band broader and a little higher up, broken by oblique light lines; median line of back nearly white: mantle apparently with two processes, one on the right, the other on the left, half enveloping the shell. It has the peculiarity, when distressed, as with the warmth of the hand, of throwing itself, like a worm, with vigorous blows of its tail. Caudal pore without overhanging process (plate xi, fig. D).

Shell (pl. xi, fig. B) imperforate, globose, very thin, pellucid, dark greenish brown; suture impressed; spire short, elevated; whorls 3; aperture rounded, slightly oblique: peristome simple, flexuose above, scarcely reflected below. Greater diam. 6, lesser 5, height 3 mill.

Locality, Flanks of Pico Blanco, 3000 feet.

For jaw and lingual dentition, see generic description. Teeth, 30-12-1-12-30.

Plate xi, fig. E, represents a species very nearly allied to, if not identical with, *V. Gabbi*, from 3000-6000 feet elevation of Pico Blanco. It resembles in outline D'Orbigny's figure of *Helix progastor* (Voy. l'Amér. Merid., pl. xvii, fig. 12-15). I received a lingual membrane as belonging to this shell, and figure it on plate xi, fig. F; though I cannot help suspecting that it belongs to some species of *Bulimulus*. I did not myself extract it from the shell.

Cryptostrakon,* n. g.

Animal (pl. xi, fig. H, central figure) slug-like, cylindrical, attenuated behind; mantle slightly anterior, thin, small, oval, entirely covering the shell; distinct locomotive disk?; no caudal mucus pore; respiratory orifice on the

* *Κρυπτος, οστρακον*, concealed shell,

right of the mantle margin, slightly in advance of the centre: genital and anal orifices—? *

Shell internal (pl. xi, fig. J) rudimentary, unguiform, large, membranous, protected by an epidermis?, without distinct septa, a spiral arrangement, indicated above by depressed lines, below by raised ridges.

Jaw (pl. xi, fig. I) high, solid, decidedly arched, ends scarcely attenuated; anterior surface with a few stout ribs, denticulating the lower margin.

Lingual membrane (pl. xi, fig. K) as usual in *Polygyra*, *Stenotrema*, &c. Long and narrow. Central teeth tricuspid, laterals bicuspid; marginals quadrate, irregularly bicuspid, the inner cutting points the larger and bifid.

Known only by *C. Gabbi*, described below.

This curious slug may at once be distinguished from all others by its rudimentary shell, entirely concealed by the mantle, and of about similar size. The shell has no distinct whorls, but a spiral arrangement is indicated on the upper surface by impressed lines, on the lower surface by a raised spiral ridge. The edge of this ridge is reflected, in dried specimens, for about one-half whorl, giving a *Haliotis*-like character to the shell. The shells of *Mariella*, *Gaetis*, and *Parmella* are somewhat similar to this, but those genera differ widely in their other characters, especially the jaw and lingual dentition. Indeed, there is no known slug combining all the generic characters of this, so that I am forced to suggest a generic name.

The dried animal reminds me of Semper's figure (Phil. Arch.) of dried *Vitrinopsis*, on account of the small size of the dried body compared to that of the shell.

* Animal limaciforme, subcylindricum, postice attenuatum. Pallium subcentrale, tenue, paululum anterior, parvum, ovatum, testam includens. Discus gressorius? Porus mucosus nullus. Apertura respiratoria ad dextram pallii in parte vix anteriori marginis Apertura genitalis et analis—?

Testa interna, magna, membranacea, (epidermide protecta?) unguiformis paucispira.

Maxilla solida, valde arcuata, costis paucis validis exarata.

Lamina lingualis ut in *Polygyra*, *Stenotrema*, &c. Dentes centrales tricuspidatæ, laterales bicuspidatæ, marginales quadratæ, irregulariter bicuspidatæ, papillis internis majoribus, bifidis.

Cryptostrakon Gabbi, n. s.

(Pl. xi, fig. H.) Animal varying from black to shades of brown, and variously mottled with black or dark brown; usually a little greenish on the shell; darkest posteriorly. Length of dried specimens corresponding to size of Dr. Gabb's figure.

Internal shell (pl. xi, fig. J) rudimentary, about 14 mill. in greatest length; with concentric lines of growth; very membranous; about two whorls are indicated (see generic description).

Jaw strongly arcuate, ends blunt, but little attenuated; anterior surface with two stout decided ribs, denticulating either margin, and several other subobsolete ribs (pl. xi, fig I).

Lingual membrane (pl. xi, fig. K) long and narrow. Teeth 52-1-52, with 22 laterals, the 23d tooth having its inner cutting point bifid. Marginals low, wide, with one inner, long, wide, oblique, bluntly bifid cutting point, and one outer, short cutting point.

Locality, Flanks of Pico Blanco, 5000-7000 feet elevation.

***Limax semitectus*, Mörch?**

Plate xi, fig. O, is copied from an original drawing by Dr. Gabb, of a slug found by him on plantain leaves and stalks at Borubeta on the Uren, Costa Rica, altitude 2500 feet. From his notes it appears that the color is dark brownish-green; no spots; generally wrinkled. Length 0.7 inch. Head slender and projecting considerably beyond the mantle; tail very short, barely perceptible under the mantle. From dried specimens brought by Dr. Gabb, I am confident that the mantle and orifice of respiration are as given by me in fig. O. The size of the mantle suggests the identity of the slug with *Limax* (*Megapelta*) *semitectus*, Mörch, Jour. Conch., VI, p. 282, t. 10, f. 7. (*Limax*, *Krynckia*, *semitectus* of same author, 1857, l. c., p. 341). From the specimens preserved in spirits, I cannot detect the orifice of respiration, but evidently there is a locomotive disk, an internal shell like that of *Limax*, and the jaw of *Limax* (pl. xi, fig. P).

The lingual membrane (pl. xi, fig. Q) is long and narrow. There are 44-1-44 teeth. The centrals have side cusps and cutting points. The laterals, 12 in number on each side of the central, are bicuspid; the marginals are aculeate, all of them

are bifid by having the side spur often found on the side marginals in this genus. The 13th, 14th, and 15th teeth form the transition into the marginals.

Glandina (a large species not yet identified).

The lingual membrane is as usual in the genus. There are 33-1-33 teeth.

Helix (a small unidentified species).

Jaw not observed.

Lingual membrane (plate xi, fig. G), long and narrow. Teeth 15-1-15. Centrals with a base of attachment longer than wide, with lower lateral expansions; reflection large, decidedly tricuspid, each cusp surmounted by a cutting point. Laterals like the centrals, but asymmetrical and consequently bicuspid. Marginals low, wide, irregularly denticulated or serrate, the inner three cutting points being longer than the outer ones, of which there are several.

Locality, Upper Tirili River.

Tebennophorus.

There are several drawings of slugs of this genus, apparently all referable to one species. It may be that described by Mörch (Mal. Blatt., VI, 109) as *Costaricensis*.

Several of these figures are given in plate xi, fig. M.

The jaw of this is strongly arched, of equal width to its blunt extremities. There are subobsolete anterior ribs about the centre of the jaw, the ends of five of which denticulate the cutting margin.

The lingual dentition is figured on plate xi, fig. N. There are about 28-1-28 teeth. The centrals have a long base of attachment, with a strong line of reinforcement running parallel to its margin at the lower edge and for a short distance at the sides. The reflection is small, and bears a short, stout median cusp, and small stout side cusps, all three cusps bearing short, stout cutting points. The lateral teeth are like the centrals, but asymmetrical by the suppression of the inner cusp and cutting point and the inner lower expansion of the base of attachment. The marginals are but a modification of the laterals, the inner cutting point not becoming bifid, though

the outer one is so on the extreme marginals. There are hardly more than twelve perfect laterals. The change into marginals is very gradual.

Veronicella ———.

Jaw as usual in the genus: 30 to 40 ribs.

Lingual membrane as usual in the genus. See Terr. Moll. U. S., v, 240.

The species is unknown to me. Its body is long and narrow.

Bulimulus Irazuensis, Angas.*

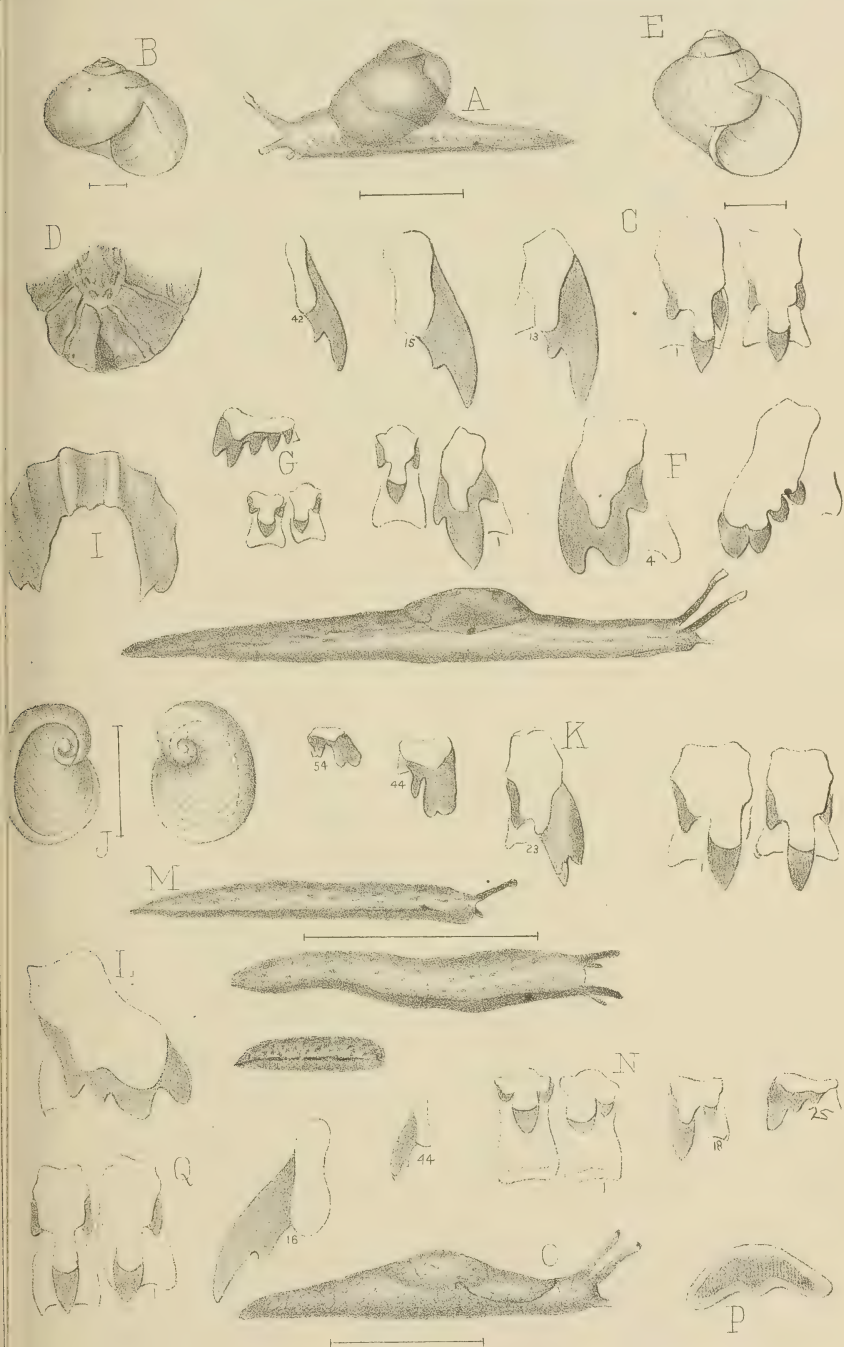
Pl. XI. fig. L, represents an extreme lateral tooth of this species. The laterals are extremely numerous, reaching quite to the outer edge of the membrane, without changing into marginals. I could not detect the central or first lateral teeth.

The jaw is of the same type as that figured by me (Ann. Lyc. N. H. of N. Y., 1875, XI, pl. XVI, fig. A) of *B. limnaoides*, Fèr. The median ribs in this species, however, are very oblique. In all there are about 32 ribs.

* Proc. Zool. Soc., Jan. 1878, 73, Pl. V, figs. 17-20.

EXPLANATION OF PLATE XI.

Fig. A	VELIFERA GABBI,.....	Animal in motion.
B	.....	Shell.
C	.....*	Lingual Dentition.
D	.....	Caudal mucus-pore.
E	same?.....	Shell.
F	.....	Lingual Dentition.
G	Small species of <i>Helix</i>	Lingual Dentition. The extreme marginal on a larger scale.
H	<i>Cryptostrakon Gabbi</i> ,.....	Animal in motion.
I	.....	Jaw.
J	.....	Rudimentary Shell.
K	.....	Lingual Dentition.
L	<i>Bulimulus Irazuensis</i> ,.....	Extreme lateral tooth.
M	<i>Tebennophorus</i>	Animal.
N	.....	Lingual Dentition.
O	<i>Limax semitectus</i> ?.....	Animal.
P	.....	Jaw.
Q	.....	Lingual Dentition.



XXVIII.—*On certain North American Species of Zonites, etc.*

BY W. G. BINNEY.

(With Plates XIV and XV.)

Read October 20th, 1879.

Most of the following notes will serve as a supplement to "Terrestrial Mollusks and Shells of the United States," vol. V. The balance are furnished from specimens lately collected at Cape Town, South Africa, by Mr. J. S. Gibbons.

Spiraxis (Euspiraxis) Dunkeri, Pfr.

San Domingo, Mr. J. S. Gibbons.

No central teeth. (Pl. XV, Fig. N).

Glandina.

Mexico. Dr. Edward Palmer.

On pl. XIV, fig. L, I have figured the lingual dentition. There are about 32–1–32 teeth. The centrals are narrow, with a very slender cutting point.

Rhytida vernicosa, Krauss.

Cape Town, South Africa. Mr. J. S. Gibbons.

This species is placed by Von Martens in *Pella*, a subgenus of *Helix*. On examining the animal, however, I find it has no jaw, and that its lingual membrane presents the usual characters of *Rhytida*. Mr. Gibbons informs me "that the animal wants the characteristic labial palpi of the latter genus." There appears no central tooth. The rows of teeth are close together, not widely separated. There are about 14–14 teeth (Pl. XIV, Fig. I).

Stenopus? decoloratus.

Demerara. Mr. J. S. Gibbons.

This species is allied to *Zonites Cayennensis*, Pfr., of Cayenne, a species placed by Von Martens in *Mesomphix*. An examination of the jaw and lingual dentition leads me to consider it a *Stenopus* (see Morse, Ann. N. Y. Lyc., viii, 158, fig. 3). I

cannot judge of the character of the tail from the alcoholic specimens received.

The jaw is low, wide, slightly arcuate, ends blunt and but little attenuated; cutting edge without median projection.

Lingual membrane long: teeth, 23-1-23, the transverse rows arranged *en chevron*: centrals small, tricuspid: no lateral teeth: all the side teeth are aculeate marginals (Pl. XV, fig. K).

Macrocyclus Hemphilli, n. sp.

At Olympia, Oregon, Mr. H. Hemphill collected several specimens of a *Macrocyclus* (pl. XV, fig. M), which appears to be distinct from, though nearly allied to, *M. Vancouverensis*. It may be best described by saying that—

The umbilicus is narrower and not excavated so much—the termination of the last whorl not receding from the umbilicus as in all the forms of *Vancouverensis* and *concava*—in all, the whorls are more or less strongly striated within the umbilicus—often almost ribbed in *concava*; not so in this shell—the texture of the shell is glassy like *Hyalina*, and there is no trace of the microscopic spiral lines found in all the other forms;—beneath, the last whorl is proportionately wider. The greater diameter is 14 mill.; lesser, 10; height, 5.

The jaw and lingual dentition are as usual in the genus (See Terr. Moll. of U. S., vol. V, p. 88). I could not distinguish the characters of the central tooth in this species.

Vitrinizonites latissimus, Lewis.

I have already, in the Bulletin of the Museum of Comparative Zoology, vol. V, No. 16, p. 333, given a description of this genus and a figure of its lingual dentition. I here add a figure of the animal in motion (pl. XIV, fig. A), not fully extended. The caudal mucus-pore is circular, bordered with a narrow transversely grooved rim; and when closed is covered completely. When open the cover is raised along its longitudinal centre, into a sharp carina, leaving posteriorly when seen from behind, an erect triangular opening. It thus differs from the simple longitudinal slit found in most of the American species of *Zonites*, such as *friabilis*, *capnodes*, *fuliginosus*, *inornatus*, *demissus*, *ligerus*, *suppressus*, the last figured in Terr. Moll., V, fig. 47. *Z. laevigatus*, however, has a nearer approach to the circular pore of *Vitrinizonites*.

The lingual dentition (see Bull. Mus. C. Zool., l. c.) is nearer

to that of *Z. laevigatus* than any other American species. Like that, there are no perfect lateral teeth, but only decided transition teeth.

The genitalia are figured on plate XIV, fig. B. The ovary is very large (*ov*) and stout: the genital bladder (*g. b.*) is globular on a short, narrow duct: the penis-sac (*p. s.*) is very long, narrow, cylindrical, receiving the retractor muscle (*r.*) near its basal termination, and merging at its apex into the vas deferens (*v. d.*) The penis-sac has not the accessory process found in *Zonites capnodes*, *friabilis*, *laevigatus*, *inornatus*, *fuliginosus*, and *Rugeli*.

***Zonites capnodes*, W. G. B.**

Living specimens received from near Knoxville, Tenn., through the kindness of Mrs. G. Andrews, have enabled me to figure (pl. XIV, fig. C) the genitalia. The genital bladder (*g. b.*) is large, globular, on a short, narrow duct: the penis-sac (*p. s.*) has the same peculiar accessory process which I have (Terr. Moll., V) figured in those of *Z. laevigatus*, *friabilis* and *inornatus*.

It is in many individuals more easy to distinguish *capnodes* from *fuliginosus* by the genitalia and dentition than by the shell.

***Zonites subplanus*, Binn.**

Roan Mt., N. C. Mrs. G. Andrews.

I have already stated that the dentition of this species resembles that of *Z. inornatus*. I here give a figure of it on pl. XIV, fig. J.

***Zonites Rugeli*, n. sp.**

On Roan Mountain, Mitchell Co., N. C., Mrs. G. Andrews found numerous specimens of a *Zonites*, for which, proving new to science, I propose the name of its discoverer.

Shell (pl. XV, fig. H) depressed globose, perforated, thin, delicately wrinkled, the apical whorls sometimes striate, greenish horn-colored, dark smoky above; spire slightly elevated, apex flat; whorls 6, slightly rounded, the last globose, scarcely excavated at the perforation; aperture large, rounded, oblique; peristome simple, thin; ends slightly approaching; the columellar one scarcely broadened. Diam., larger 19; lesser 15; height 9 mill.

When first received, I believed this to be an extremely globose form of *Z. inornatus*, but an examination of the lingual dentition showed this to be impossible.

On pl. XIV, fig. D, I have given a figure of the genitalia. It will be seen that the accessory part of the penis-sac is in this species continued to a point beyond the retractor-muscle: otherwise the genitalia are very similar to those of *capnodes*, *friabilis*, *inornatus*, *laevigatus*, and *fuliginosus*. The last species I find to have this accessory process also, though it is not given in Leidy's figure.

Jaw as usual in the genus. Lingual membrane (pl. XV, fig. I) as usual: teeth 38-1-38. There are about 4 or 5 laterals; the 8th is a pure marginal on either side of the central line. It will be seen in Terr. Moll., V, that *inornatus*, *subplanus* and *laevigatus* are peculiar in having no perfect lateral teeth, but only transition teeth: *fuliginosus*, *capnodes*, and *friabilis*, as well as *Rugeli*, have well formed laterals, differing in number in the various species: thus the lingual dentition in this group is a good guide in distinguishing the species.

The animal is dark slate-colored: the caudal mucus-pore is a longitudinal slit as in *suppressus* (see Terr. Moll., V).

Some individuals have their apical whorls striate, as in *Z. subplanus*.

***Zonites placentula*, Shuttl.**

On pl. XV, fig. A, I give a figure of what appears to be the true *placentula* as described by Shuttleworth (whose description is translated in Moll., V, p. 124). The shell there figured, and also figured in this paper, pl. XV, fig. E, is either a distinct species, or an elevated edentate form of *lasmodon*.

***Zonites Andrewsii*, n. sp.**

On pl. XV, fig. D, is an illustration of a shell lately received from Mrs. G. Andrews, who collected it on Roan Mountain, Mitchell Co., N. C. It has the general appearance of *Z. signifi-cans*, *multidentatus*, and *lasmodon*, but differs so decidedly from each, that I propose to designate it by the name of its discoverer. A full specific description can be given later. Compared with

Z. lasmodon, it has fully 8 whorls, is $6\frac{1}{2}$ mill. in diameter, the umbilicus 1 mill. wide, whilst *lasmodon* with 7 whorls is 7 mill. in diameter, with an umbilicus 2 mill. wide : the Roan Mountain shell has also five parallel lamellæ, while *lasmodon* has only two, or at most three, and does not show the successive rows of lamellæ which are characteristic of *Andrewsi*, radiating from the centre.

From *Z. significans* it differs in its larger size, greater number of whorls, much wider umbilicus, and in the character of its internal denticles, which are long and winding on the wall of the whorl ; while in *significans* the denticles are simply erect and conical, with broad base. The same differences distinguish it from *multidentatus*, which is still smaller than *significans*, and has a much narrower umbilicus.

***Zonites macilentus*, Shuttl.**

On pl. XV, fig. B, I give an illustration of what appears to be the true *macilentus* (see Terr. Moll., III, p. 20), which seems to be distinct from *lasmodon*, judging by specimens lately received.

***Zonites multidentatus*, Binn.**

For the sake of comparison with *Z. significans* and allied species, I give on pl. XV, fig. F, an enlarged view of this species, more satisfactory than that given in Terr. Moll. U. S., III.

***Zonites significans*, Bl.**

By an unfortunate oversight, another shell was used to illustrate this species in Terr. Moll., V, p. 132. I here figure (pl. XV, fig. G) an authentic specimen.

On pl. XIV, fig. F, I have given, for the sake of comparison, an illustration of *Z. multidentatus*, the nearly allied species.

***Zonites cuspidatus*, Lewis.**

In the Proceedings of the Academy of Natural Sciences of Philadelphia, 1875, p. 334, this is mentioned as probably a var. of *Z. cerinoideus*. I have received authentic specimens from

Dr. Lewis, and find them to be rather a variety of *gularis*—one of the many curious forms of that variable species. The internal tooth-like processes, strongly curved one towards the other, form almost an arched space. On pl. XV, fig. C, will be found a figure of this form. Dr. Lewis's specimens were from Munroe Co., Tenn. (Miss Law). I have also received it from Roan Mountain, N. C. (Mrs. G. Andrews).

Tebennophorus, —.

From Dr. W. Newcomb I have received a slug which, from its outward characters, jaw and lingual membrane, surely is a species of *Tebennophorus*. It is mentioned here, as the locality is new for the genus—Brazil, 300 miles up the river from Para.

Mesodon dentifera, Binn.

Vermont.

On pl. XIV, fig. G, I have figured the genitalia of this species, hitherto unknown.

The genital bladder (*g. b.*) is small, oval, on a short duct which is greatly swollen at a short distance below the bladder: the penis-sac (*p. s.*) is long, stout and contracted, at a short distance below its blunt end: the retractor is inserted in the vas deferens at about the middle of its length.

In another individual, the construction of the penis-sac was not so well developed.

Mesodon Andrewsii, n. sp.

At Roan Mountain, Mitchell Co., N. C., Mrs. Andrews collected numerous specimens of a *Mesodon* which cannot be referred to any known species.

Shell imperforate, globose, very thin, with delicate wrinkles of growth and microscopic revolving striae; horn color; spire elevated, conic, apex obtuse; whorls six, convex, the last greatly swollen; peristome white, thickened, slightly reflected, ends separated, the columellar one expanded. Greater diameter 25 mill., lesser 20; height 14 (Plate XV, Fig. L).

The absence of limestone on Roan Mountain accounts for the extreme thinness of the shell.

It can scarcely be said to resemble closely any known species

of *Mesodon*, though somewhat like a gigantic *M. Mitchelliana*.

The jaw has 16 ribs.

The lingual membrane (pl. XIV, fig. F) is long and narrow : teeth 64-1-64, with about 15 perfect laterals on either side of the central line. The central and lateral teeth have no side cusps or cutting points, and only on the extreme marginals does a side cutting point appear. The cutting point of the marginals is long. Thus the dentition is like that of *clausa* and *thyroides*.

The genitalia are figured on pl. XIV, fig. E. The genital bladder (*g. b.*) is large, oval, on a short, narrow duct : the penis-sac (*p. s.*) is long and stout, with a sub-central constriction : the prostate gland (*pr.*) is highly developed.

***Helix* (*Dorcasia*?) *globulus*, Müll.**

Cape Town, South Africa, Mr. J. S. Gibbons.

Jaw low, wide, scarcely arcuate, ends not acuminate : no anterior ribs.

Lingual membrane wide, with about 40-1-40 teeth. Laterals as well as centrals tricuspid. Pl. XIV, fig. K, gives a central, with its adjacent lateral and several inner marginal teeth.

Both jaw and lingual membrane are quite different from those hitherto observed in *Dorcasia*, to which sub-genus Von Martens refers the species.

Mr. Gibbons informs me that the eggs of this species are of very large size. It lives on sandy flats close to the sea margin, burying itself in the sand by day.

***Helix* (*Pella*) *rariplicata*, Benson.**

Cape Town, South Africa, Mr. J. S. Gibbons.

The jaw has ribs like those figured for *Microphysa Lansingi*, in Terr. Moll. U. S., V,—i. e., flat, crowded, wide, numerous.

The lingual membrane is long and narrow. There are about 16-1-16 teeth, with four laterals on either side of the central tooth. The central tooth has small detached side cusps and cutting points, as in *Strophia*, and the laterals are quite similar—a very unusual arrangement in the *Helicidae*. The marginals are low, wide, with one inner, oblique, wide bifid cutting point.

The central, with its adjacent laterals and an inner marginal tooth, are given in pl. XIV, fig. H.

Buliminus Natalensis, Kr., var. **Draakensburgensis**, E. Smith

Cape Town, South Africa, Mr. J. S. Gibbons.

The species is placed by Von Martens in the subgenus *Pachnodus* of *Buliminus*.

The jaw is very thin, slightly arched, low ; ends blunt ; scarcely attenuated ; anterior surface with above forty ill-defined, flat, crowded ribs, scarcely denticulating either margin.

Lingual membrane (pl. XIV, fig. J) long and narrow. Central teeth tricuspid ; laterals bicuspid ; marginals quadrate, with one long, large, oblique inner cutting point, and one outer bifid cutting point. There are 54-1-54 teeth, with about 14 laterals on each side of the central line.

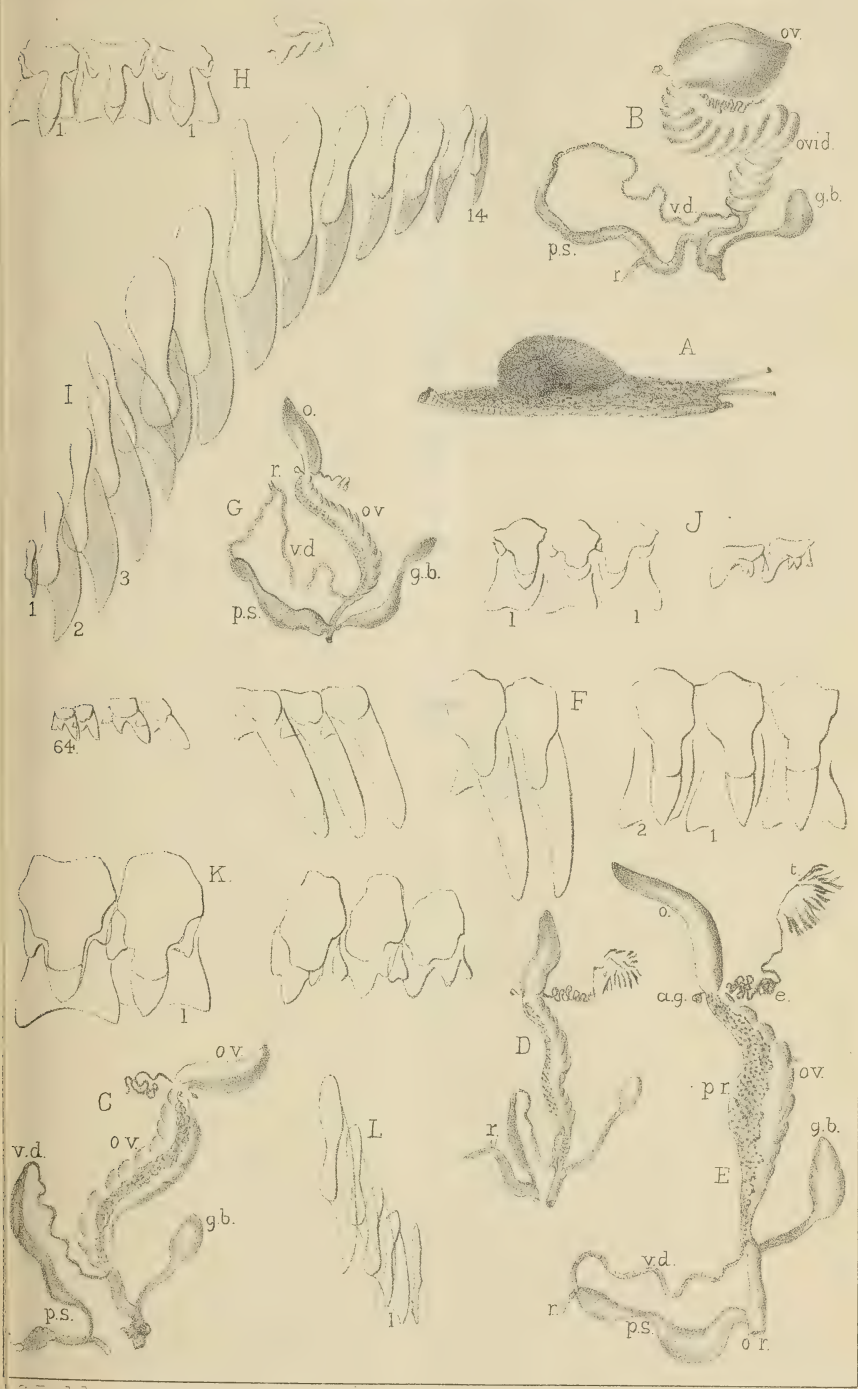
EXPLANATION OF PLATE XIV.

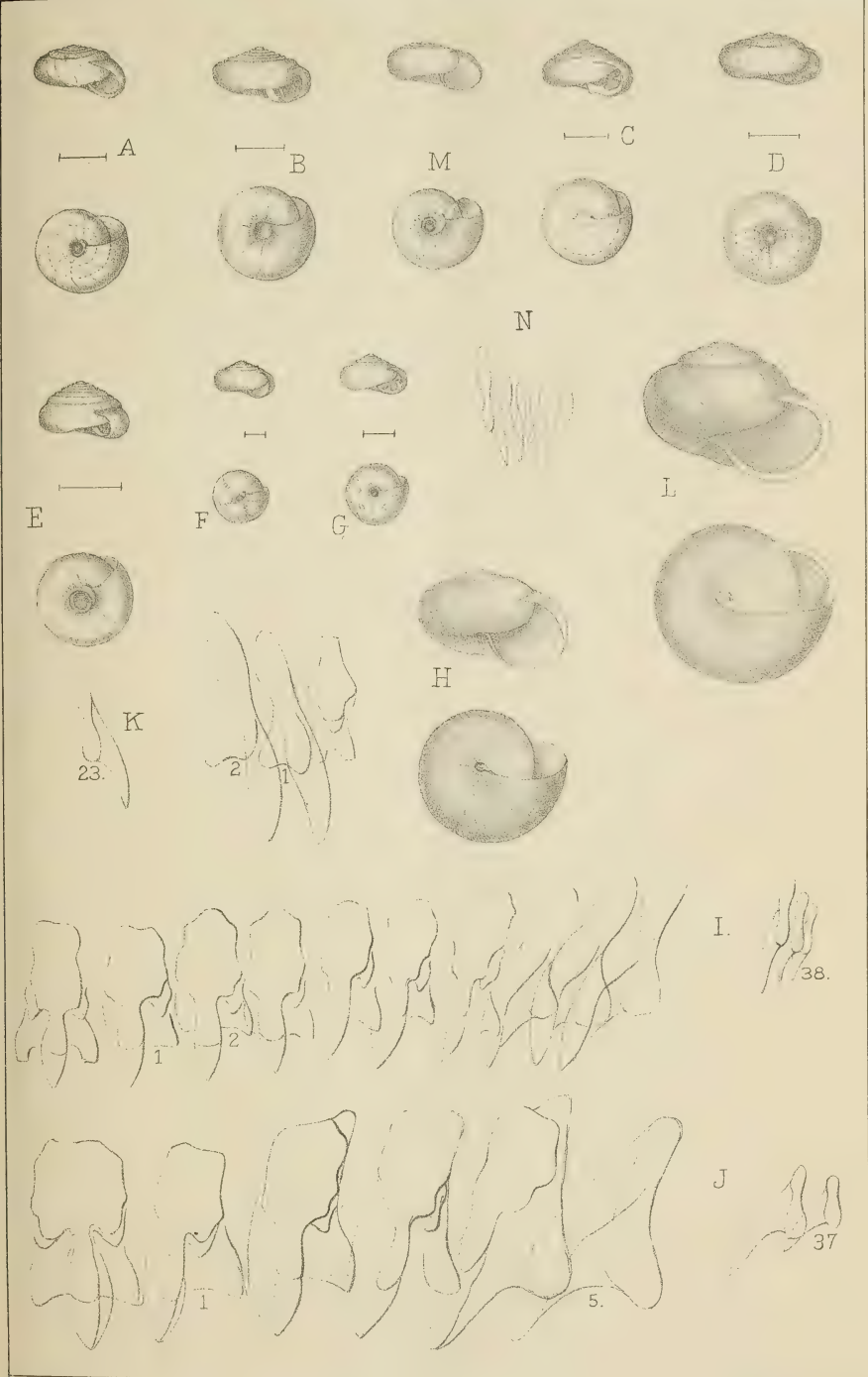
- Fig. A *Vitrinizonites latissimus*, animal in motion, not fully extended :
drawn by Miss Emma Pringle.
- “ B “ “ genitalia.
- “ C *Zonites capnodes*, genitalia.
- “ D “ *Rugeli*, “
- “ E *Mesodon Andrews*, “
- “ F “ “ lingual membrane.
- “ G *Mesodon dentifera*, genitalia.
- “ H *Helix rariplicata*, central, adjacent laterals, and inner marginals.
- “ I *Rhytida vernicosa*, Kraus, dentition.
- “ J *Buliminus Natalensis*, lingual membrane.
- “ K *Helix globulus*, lingual membrane.
- “ L *Glandina*,—dentition (see p. 355).

EXPLANATION OF PLATE XV.

- Fig. A. *Zonites placentula*, Shuttl.
- “ B “ *macilentus*, Shuttl.
- “ C “ *cuspidatus*, Lewis.
- “ D “ *Andrewsi*.
- “ E “ *lasmodon*, var. ? (see. p. 358)
- “ F “ *multidentatus*, Binn.
- “ G “ *significans*, Bland.
- “ H “ *Rugeli*.
- “ I Dentition of same.
- “ J “ “ *Zonites subplanus*, Binn.
- “ K “ “ *Stenopus* ? *decoloratus*
- “ L *Mesodon Andrews*,
- “ M *Macrocyclus Hemphilli*.
- “ N *Spiraxis Dunkeri*, Pfr., dentition.

The figures of shells on this plate were drawn from nature by Mr. Arthur F. Gray, of Danversport, Mass.,—those of dentition by W. G. B.





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VOL. V. No. 16.

ON THE JAW AND LINGUAL DENTITION OF CERTAIN TERRESTRIAL MOLLUSKS. By W. G. BINNEY.

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DECEMBER, 1879.

No. 16. — *On the Jaw and Lingual Dentition of certain Terrestrial Mollusks.* By W. G. BINNEY.

(WITH TWO PLATES.)

CHLAMYDEPHORUS.*

Animal (Pl. II. Fig. A) limaciform ; mantle covering the whole body, with an orifice on the centre of the back near the tail, enclosing at the same part a subhexagonal, solid, internal shelly plate : no caudal mucus pore ; distinct locomotive disk to foot ? external excretory, respiratory, and generative orifices ? tentacles and eye-peduncles two each : no jaw : teeth of lingual membrane (Pl. II. Fig. B) as in *Glandina*, arranged in chevron, aculeate.

This generic name is suggested for a peculiar slug collected by Mr. J. S. Gibbons in Natal Colony, Africa, and submitted by him to me. Its mantle covering the whole body can be compared only to that of *Tebennophorus* (*Megimathium*, *Incilaria*, *Philomycus*), *Pallifera*, *Athoracophorus* (*Janella*, *Aneitea*, *Triboniophorus*, *Aneitum*), *Veronicella*, and *Vaginulus* as restricted by Stoliczka (Journ. Asiatic Soc. Bengal, N. S. xlii. pt. 2, pp. 33–37) to the agnathous species resembling *Veronicella*. This last genus, *Vaginulus*, can alone be compared with the slug before me in wanting a jaw and having *Glandina*-like teeth on its lingual membrane, and at the same time not having any external shell. It differs, however, from the Natal slug in wanting the peculiar dorsal orifice, and the internal shelly plate. I am forced, therefore, to suggest a new name for this slug. The dried condition of the animal prevents me learning the position of the external orifice of generation ; I suspect that of respiratory and excretory organs to be through the hole on the centre of the animal's back.

The single specimen received is deposited in the collection of the Philadelphia Academy of Natural Sciences, together with the internal shelly plate and the mounted lingual membrane.

Chlamydephorus Gibbonsi.

Animal (Pl. II. Fig. A) elongate, rather slender, cylindrical, rather more than 3 inches long when fully extended, tapering towards head, broadest about $\frac{1}{2}$ inch from tail, towards which it slopes ; tail rather blunt ; dorsum rounded, head small ; color a dark, dull orange, thickly mottled, and marbled with dark olive brown, the margin of the foot and mesial line of dorsum being the only parts where the ground color is well seen. A slight eminence on the broadest part of the body (near posterior end) is perforated by a round orifice, a line or rather more in diameter ; from this small orifice furrows radiate, passing to tail, to the margin of foot and forwards ; dorsum finely sulcato-striate from head to orifice, the striae being granulose. A row of small regular tubercles runs along

* χλαμύς, φέρω.

mesial line from head to prominence; eye-peduncles very short, cylindrical, retractile, and of a dark neutral color; tentacles similar, but shorter and lighter in hue; below these last are a small subpellucid pair of false tentacles, a prolongation of the sole of the foot; below, the foot is dull opaque white with a tallowy yellow tint and with an indistinct bluish streak along middle.

One specimen under a stone in a wood, Ungeni Valley, Natal Colony.

When the mollusk wishes to rest it withdraws its head completely, brings together the two margins of the foot, and then doubles under the tail end.

The above is Mr. Gibbons's description. In my generic description it will be seen that there is no jaw. The lingual membrane is long and broad, consisting of about 52 chevron-shaped rows of 27-1-27 teeth, all as in *Glandina*, the central one differing only in being smaller than the adjacent marginals, and symmetrical, with a long, slender cutting point: there are no laterals, all the side teeth being purely aculeate marginals and first rapidly increasing and then gradually decreasing in size as they pass off laterally, as is usual in *Glandina* (Pl. II. Fig. B). Buccal mass very large indeed.

The internal shelly plate is quite thick; it was in several pieces when found by me, but I doubt not its being in a single subhexagonal plate when perfect. It is 3 mill. long.

I regret that the dried condition of the single specimen received prevented my examining the character of the tentacles and the internal anatomy, especially to learn if the sexual organs be separated, as in *Veronicella* and *Vaginulus*.

***Onchidella Carpenteri*, W. G. BINN.**

Gulf of California. Mr. R. E. C. Stearns.

There is no jaw, which fact renders still more doubtful the presence of one in *Onchidella borealis* as published by me in Terr. Moll. U. S., V. 178.

The lingual dentition is of the same type as that of *O. borealis* (l. c.). The upper margin of the base of attachment is still more prolonged in *O. Carpenteri*.

***Zonites Whitneyi*, NEWCOMB.**

On p. 432 of Terr. Moll. of United States, Vol. V., will be found a description of the dentition of this species, which is figured here (Pl. I. Fig. I) by showing a central with its adjacent lateral and one marginal tooth.

***Zonites subplanus*, BINNEY.**

At the same locality where Miss Law found *Vitrinizonites latissimus* (q. v.) she found several specimens of *Zonites subplanus*, a dark, almost black variety. As would be anticipated, the species has the same dentition as *Zonites inornatus*, to which it is nearly allied.

***Janulus stephanophora*, DESH.**

Madeira. Dr. Hillebrand to Dr. Newcomb.

Jaw strongly arched, ends pointed, cutting margin with a sharp, greatly produced median projection.

Lingual membrane not observed.

Janulus bifrons, Lowe.

Madeira. Dr. Hillebrand to Dr. Newcomb.

Jaw smooth with median projection.

Lingual membrane with 34-1-34 teeth, of which 4 on each side are laterals. All as in *Zonites*, i. e. centrals tricuspid, laterals bicuspid, marginals aculeate.

VITRINIZONITES, n. g.

Animal heliciform, blunt before, in motion greatly acuminate behind: mantle subcentral, protected by an external shell: two longitudinal furrows above the margin of the foot, meeting over a round caudal mucus pore: distinct locomotive disk to foot: external orifice of combined generative organs on right side of body, far behind the eye-peduncles; of respiratory and excretory organs on the right of the mantle under the peristome: jaw smooth with median projection: lingual membrane (Pl. II. Fig. H) as in *Zonites*, central teeth tricuspid, lateral teeth bicuspid, marginals aculeate.

Shell external, *Vitrina*-like.

The above generic name is proposed for the shell described as *Vitrina latissima* (see Terr. Moll. U. S., V. 136, Fig. 51), as it combines the characters of *Vitrina* and *Zonites*. The animal differs from *Vitrina* by having simple, not bifid marginal teeth to the lingual membrane, and by a caudal mucus pore with longitudinal furrows above the margin of the foot, and by the want of an appendiculate mantle. From *Zonites* it differs only in the form of the shell, though the caudal mucus pore seems to be circular, with projecting process when open, rather than a simple longitudinal slit, as in the *Zonites suppressus*. There appears no developed appendiculate mantle process.

I am indebted to Miss Annie E. Law for the opportunity of examining the specimen. She collected it in June, 1879, at the original locality, Bald Mountain, Blount Co., Tenn., on dividing line with North Carolina. At Washington Co., Tenn., it was found by Dr. Rugel. Mrs. G. Andrews found it on Roan Mountain, in North Carolina (over 6,000 feet), on the dividing line with Carter Co., Tenn.

The lingual membrane is broad and not long, the ends are bluntly truncated. There are about 30 rows of 24-1-24 teeth each, arranged as in *Zonites*. There are six laterals, scarcely one perfect, mostly transition teeth, on each side of the central line; the seventh tooth is a marginal, the twelfth tooth is the largest. Plate II. Fig. H shows all the various forms of teeth on the membrane.

Urocyclus Kirkii, GRAY?

I am indebted to Mr. J. S. Gibbons for the opportunity of examining a curious slug collected by him in Mozambique. He suggests that it may be *Urocyclus Kirkii*, Gray (Proc. Zool. Soc., 1864, p. 250). He thus describes, in the Quarterly Journal of Conchology, the living animal:—

“Body slender, tapering, keeled, with a sharply pointed tail; on each side of

dorsum a slight and rounded ridge runs from shield to tail ; surface longitudinally sulcate, of a dark orange color ; keel and lateral ridges light lemon ; the sulci and their anastomosing branches dusky ; head semi-pellucid, neck slender and compressed ; shield anterior, elongate, very convex from side to side, thin and rounded in front, bluntly rostrate behind ; a large swelling rather behind the middle indicates the situation of the shell, the apex of which is sometimes visible through a small longitudinal slit situated on a slight eminence nearly at the end of the posterior portion of the shield ; surface is a rich orange, thickly studded with small oval granules of a rich lemon color : respiratory orifice large, $\frac{2}{3}$ from anterior end of shield ; eye-peduncles long and slender, semi-transparent, of a dusky orange ; head and tentacles very beautifully granulate, granules small, regular, and of a pearly appearance ; the margin of the body to the extent of 2 mill. is separated by a slight furrow uncovered by integument, grayish, smooth, and secreting mucus very abundantly ; at the tail this margin is 6 mill. in extent and bears a small oval mucus pore ; length of pore, when fully extended, 3 mill.

"On bushes at Mozambique, East Africa.

"The slit in the shield is capable of considerable enlargement. Sometimes a good deal of the shell is visible ; usually the orifice is so contracted that none of it can be seen.

"A comparison of this mollusk with the animal of the African *Nanina* shows some striking points of resemblance ; in both there is a furrow running from head to upper part of mucus pore, below which the surface is smooth and mucus-secreting ; the pore is similar, and the caudal spine of *Nanina* is indicated in *Urocyclus* by the peaked termination of the integument behind. Lastly, if we suppose the orifice in the shield of *Urocyclus* to be greatly enlarged, and the rudimentary shell developed, we shall have an arrangement of the shield similar to the collar of *Nanina*, namely, part investing the peristome of shell, and part covering dorsum of body."

The dried carcass, as I received it, is about 32 mill. long. The respiratory orifice seems rather anterior than posterior. The mantle is quite large, with a posterior orifice. The internal plate is simple, 7 mill. long, thin, slightly convex, with posterior nucleus and concentric lines of growth. There is a distinct locomotive disk ; longitudinal furrows above the margin of the foot, and a longitudinal caudal mucus pore. The jaw is very low, slightly arcuate, ends scarcely attenuated, blunt, anterior surface without ribs, no median projection to the cutting edge (Pl. II. Fig. C). The lingual membrane (Pl. II. Fig. D) shows a tricuspid central tooth and bicuspid laterals, as in *Zonites*, the marginals are aculeate, the cutting edge bifid.

This slug can hardly belong to *Tennentia*, which has a different shelly plate, a median projection to the cutting edge of its jaw, no opening to the mantle. *Parmarion* is described as very near this slug, but its respiratory orifice is posterior, the caudal pore is more developed, not so linear, in a different position, and apparently with a horn-shaped process ; its internal plate has a lateral nucleus, while in our slug it is posterior, and its jaw has a median projection. *Dendrolimax* has a much smaller shelly plate, a horn-shaped caudal process, and median projection to the cutting edge of its jaw. It seems, therefore, best to consider it an *Urocyclus*, as suggested by Mr. Gibbons.

Cionella Gloynei, GIBBONS, n. sp.

Under stones at Curaçao. Mr. J. S. Gibbons. (Pl. I. Fig. H.)

Both jaw and lingual membrane are as usual in this genus and its allies. (See Terr. Moll. U. S., V.) The figure gives one central and its adjacent lateral tooth.

Pupa contracta, SAY.

To the synonymy add *Pupa Cincinnatiensis*, Judge, Quarterly Journal of Conchology, I. 343, fig., 1878.

Hemitrochus Milleri, PFR.

Fortune Island, Bahamas. Dr. J. J. Brown to Mr. Bland.

Jaw arched, high, ends blunt, scarcely acuminate: anterior surface with one single rib-like prominence, extended into a decided median projection to the cutting edge of the jaw. (Pl. I. Fig. B.)

Lingual membrane with about 33-1-33 teeth. Pl. I. Fig. A shows the gradual change from centrals to extreme marginals. The same type of teeth has been noticed by me in *varians*, *Troscheli*, *graminicola*, and *gallopavonis*. These species differ, however, from *Milleri* by having no rib-like prominence on the anterior surface of their jaw, but a simple median projection to its cutting edge. Like variation as to the presence or absence of ribs on the jaw has been noticed by me in *Dentellaria* and other genera, a fact throwing doubt on the value of the character of ribs on the jaw as of generic weight.

Plagioptycha Duclosiana, FÉR.

Exuma, Bahamas. Dr. J. J. Brown to Mr. Bland.

Jaw as described under *Hemitrochus Milleri*.

Lingual membrane with about 30-1-30 teeth. The changes from central to marginal teeth are shown in Pl. I. Fig. C.

Microphysa Stearnsi, BL.

Olympia, Washington Territory. H. Hemphill.

From an examination of the jaw and lingual dentition it appears that this species is not a *Zonites*, as originally described, but rather a *Microphysa*, like *M. Lansingi* and *M. Ingersolli*. With the former it shares the peculiarity of having a ribbed jaw and aculeate marginal teeth to its lingual membrane. (See Terr. Moll., V. 172, Fig. 21.)

The jaw has over 19 ribs of the same type as those of *M. Lansingi* (l. c.). (See Pl. I. Fig. N.) A portion only of the jaw is figured.

The lingual membrane (Pl. I. Fig. M) has four laterals on each side of the central tooth.

Triodopsis vultuosa, GOULD.

Texas. Professor A. G. Wetherby. On Pl. II. Fig. C, is given a figure of the dentition of this species, which I have described on p. 313 of Terr. Moll. U. S., Vol. V.

Mesodon Sayii, BINNEY, var. Chilhoweensis.

An opportunity of examining the animal of this large form of *M. Sayii*, for which I am indebted to Dr. Lewis, shows that the genital system (Pl. II. Fig. I) is similar to that of the typical form, excepting that the penis sac is still more developed, surpassing by three times the whole genital system in length. (See Terr. Moll. U. S., V., Pl. XI. Fig. 11.)

The jaw and lingual dentition are the same as in the typical *Sayii*. I have figured on Pl. I. Fig. K, the dentition of this variety.

Mesodon devia, GOULD.

Freeport, Cowlitz Co., Washington Territory, Mr. Henry Hemphill. On Pl. II. Fig. G, I have figured the genital system of the typical form of this species: *a* is the penis sac; *b*, the genital bladder and duct.

Pomatia Humboldtiana, VAL.

The individual examined was considerably smaller than Fig. 1, Pl. XI. of *Mollusques Terr. et Fluv. du Mexique*. It was collected by Dr. E. Palmer.

The genital system is figured on Pl. II. Fig. J. The genital bladder (*g. b.*) is small, on a long narrow duct; the penis sac (*p. s.*) is long, tapering to a flagellate point, and receives the vas deferens (*v. d.*) about its middle; there is a prostate gland (*pr.*) on a short peduncle, globular, with four accessory leaflets clinging to its base, giving a general rosette-like form to the gland.

The jaw is short, arched, bluntly ending, with six broadly separated stout ribs denticulating either margin.

The lingual membrane is long and narrow. Central teeth (Pl. II. Fig. K) pear-shaped, with no side cusps or cutting points; laterals like the centrals, but asymmetrical; marginals with one long inner bifid cutting point and one smaller side cutting point.

Ochtheiphila tiarella, WEBB & BERTH.

Madeira. Dr. Hillebrand to Dr. Newcomb. The species is rarely found living.

Jaw low, slightly arcuate, ends scarcely attenuated; anterior surface with about 15 flat, broad, crowded ribs, scarcely denticulating the cutting margin.

Lingual membrane with 21-1-21 teeth of same type as *Plebecula lurida*, q. v. Laterals about 9 on each side of the central.

Ochtheiphila abjecta, LOWE.

Madeira. Dr. Hillebrand to Dr. Newcomb.

Jaw low, slightly arcuate, ends attenuated; cutting edge with a blunt median projection; no anterior ribs.

Lingual membrane with 24-1-24 teeth, of which about 4 on each side are laterals. Teeth of same type as those of *Plebecula lurida*, q. v.

Tectula lineta, Lowe.

Madeira. Dr. Hillebrand to Dr. Newcomb.

The species is viviparous.

Plebecula lurida, Lowe.

Madeira. Dr. Hillebrand to Dr. Newcomb.

Jaw low, slightly arcuate, ends scarcely attenuated. Anterior surface with about 8 broad, separated ribs.

Lingual membrane (Pl. I. Fig. L) with 32-1-32 teeth, of the usual *Helicea* type. It will be seen in the figures that the change from lateral to marginal teeth is formed with the splitting of the inner cutting point.

Leptaxis undata, Lowe.

Madeira. Dr. Hillebrand to Dr. Newcomb.

The jaw is described by Mörch as narrow, with numerous ribs converging to centre.

Lingual membrane of the individual examined peculiarly abnormal, the malformed teeth, as figured by me (Pl. I. Fig. E), being repeated often on each transverse row, and down the whole length of the lingual membrane. Such malformations are often found in lingual membranes. Fig. *a* seems to be a normal lateral tooth.

Veronicella ———.

Mozambique. Mr. J. S. Gibbons.

Jaw as usual in the genus ; over 22 ribs.

Lingual membrane as usual in the genus. (See Terrestrial Mollusks of United States, V. 240, Pl. V. Fig. P.)

Veronicella olivacea, Stearns.

Polvon, Occidental Department, Nicaragua, McNiel.

I am indebted to Professor F. W. Putnam for some of the original specimens of this species, which Mr. Stearns has also collected in California.

The jaw is as usual in the genus, with over 20 ribs.

The lingual membrane is also as usual in the genus, as described and figured by me in Terr. Moll. U. S., V. 240, Pl. V. Fig. P.

HEMPHILLIA.

I am indebted to Mr. H. Hemphill for specimens of *Hemphillia glandulosa* from Portland, Oregon, much larger than those first obtained by him, being in their contracted state over 40 mill. long. The shell is not external, as described from the small specimens first received (Terr. Moll. U. S., V.), but is quite covered by the mantle, excepting at the perforation, which is 8 mill. long by 5 broad. Fig. F of Pl. II. gives an outline of this specimen.

Simpulopsis corrugatus, GUPPY.

Trinidad. Mr. Guppy to Mr. Bland.

Jaw not observed. Lingual membrane (Pl. I. Fig. G) of the same type as figure, for *S. sulculosus*, by Heynemann, Malak, Blatt., XV., Pl. V. Fig. 10. I find the central teeth in this species distinctly tricuspid.

Bulimulus Schiedeanus, PFR. (THAUMASTUS.)

Texas. Professor A. G. Wetherby.

Jaw slightly arcuate, ends scarcely attenuated, blunt; anterior surface with 17 ribs, denticulating either margin. It is difficult to decide the exact character of these ribs. I have usually called the ribs in *Bulimulus*, *Cylindrella*, etc. narrow and widely separated. They should, perhaps, be described as very broad, with narrow interstices, and with a gradual increase of thickness towards their outer longitudinal margin. This plainly thickened margin is what I have formerly described as narrow ribs. In the jaw before me there is no tendency to oblique arrangement of the ribs at the upper central portion of the jaw.

The lingual membrane is long and narrow. Teeth of the same type as described by me under *Bul. dealbatus*, Say, in Terr. Moll. U. S., V. (See Pl. I. Fig. T.)

Bulimulus immaculatus, AD. (THAUMASTUS).

Jamaica. Mr. Bland from Mr. Gloyne.

Jaw as usual in the genus with over 36 ribs.

Lingual membrane (Pl. I. Fig. D) as in *B. laticinctus*, *Bahamensis*, *auris-leporis*, *papyraceus*, *membranaceus*, &c. Teeth very numerous; *b* shows a marginal tooth.

Macroceramus inermis, GUNDL.?

Curaçao. Mr. J. S. Gibbons.

Lingual membrane as in *Macr. Gossei* (see Terr. Moll. U. S., V. 386, Pl. X. Fig. Q).

Cylindrella Chemnitziana, FÉR.

Jamaica. Mr. Thomas Bland.

The lingual membrane is of the same type as the other species of the subgenus *Cylindrella*, s. s., described and figured by Crosse and Fischer (Journ. de Conch., 1870, Pl. IV. Fig. 1).

There are 10-1-10 teeth, with two laterals on each side of the central tooth.

Omalonyx felina, GUPPY.

Demarara. Mr. J. S. Gibbons to Mr. Bland.

Jaw as usual in the genus.

Lingual membrane (Pl. I. Fig. J) quite similar to that observed by me in individuals of the same species from Trinidad (Ann. Lyc. Nat. Hist. of New York, X. 346). Mr. Bland and myself have expressed our opinion (l. c.) that *felina* is identical with *O. unguis*.

HAVING from time to time published descriptions of the jaw and lingual dentition of numerous species of terrestrial mollusca, I have considered that a full list of the species would be of value for reference. Abbreviated references are made to the Terrestrial Air-Breathing Mollusks and Shells of the United States, Vol. V.; the Proceedings of the Academy of Natural Sciences of Philadelphia; Annals of the Lyceum of Natural History of New York; and the American Journal of Conchology. A complete list of my writings is given at the end of this paper. In the following catalogue the list of species is complete, but references are given only to the fullest description when the species has been treated in several publications. No reference to figures is given, though almost every species has been figured in the place referred to.

Many of the species were described in connection with Mr. T. Bland.

PULMONATA GEOPHILA.

Agnatha.

Chlamydephorus Gibbonsi. See this paper.

Glandina rosea, FÉR. Am. Journ. Conch., VI. 202.

solidula, PFR. Ann., X. 347.

semitarum, RANG. Phila. Ac. Proc. 1874, 49.

Phillipsi, AD. " " "

truncata, GMEL. Terr. Moll., V.

Albersi, PFR. L. & Fr. Water Shells of N. A., I. 19.

? ———. Ann. N. Y. Acad., I. 261. (= *aurata*, MOR.)

Gonospira sulcata, MÜLL. Ann., X. 222.

palanga, FÉR. Am. Journ. Conch., V. 37.

Newtoni, H. ADAMS. Phila. Proc., 1874, 47.

Mauritiana, MOR. " " 47.

modiolus, FÉR. " " 47.

Nevilli, H. ADAMS. " " 48.

Ennea clavulata, LAM. " " 48.

Onchidium Schrammi, BLAND & BINN. Ann. Lyc., X. 339.

Onchidella borealis, DALL. Terr. Moll., V.

Carpenteri, W. G. B. See this paper.

Holognatha Vitrinea.

Limax maximus, LIN. Terr. Moll., V.

flavus, LIN. " "

agrestis, LIN. " "

campestris, BINN. " "

Hewstoni, J. G. COOP. " "

montanus, ING. Ann., XI. 169.

- Limax castaneus*, ING. Terr. Moll., V.
semitectus, MÖRCH. Ann. N. Y. Acad. Nat. Sc., I. 260.
Urocyclus Kirkii, GRAY. See this paper.
Vitrina limpida, GOULD. Terr. Moll., V.
Pfeifferi, NEWC. " "
exilis, MOR. " "
Nanina Chamissoi, PFR. Ann., X. 338; Phila., 1874, 248.
radians, PFR. Ann., XI. 168.
conula, PSE. "
calculosa, GLD. "
subcircula, MOUSS. Phila., 1875, 248.
calias, BENS. Am. Journ. Conch., VII. 188.
cultrata, GOULD. " " VII. 189.
inversicolor, FÉR. Ann. X., 169.
leucostyla, PFR. "
rufizonata, H. AD. "
militaris, PFR. "
Caldwelli, BENS. Phila., 1874, 48.
Rawsoni, BARCLAY. " "
argentea, REEVE. Phila. 1875, 48.
implicata, NEVILL. " "
stylodon, PFR. " "
phylirina, MOREL. " "
Velifera Gabbi, W. G. B. Ann. N. Y. Acad. Nat. Sc., I. 258.
Trochomorpha Cressida, GLD. Ann., XI. 165.
Macrocyclus Baudoni, PET. Ann., X. 305; Am. Journ. Conch., VII. 174.
euspira, PFR. Phila., 1875, 247.
Vancouverensis, LEA. Terr. Moll., V.
sportella, GLD. " "
concava, SAY. " "
Voyana, NEWC. " "
Duranti, NEWC. " "
Vitrinizonites latissimus, LEWIS. See this paper.
Zonites Bermudensis, PFR. Phila., 1876, 183; Ann. Lyc., X. 221.
capnodes, W. G. B. Terr. Moll., V.
fuliginosus, GRIFF. " "
friabilis, W. G. B. " "
laevigatus, PFR. " "
demissus, BINN. " "
" var. *acerrus*, LEWIS. " "
ligerus, SAY. " "
intertextus, BINN. " "
inornatus, SAY. " "
subplanus, BINN. See this paper.
sculptilis, BL. Terr. Moll., V.

<i>Zonites Elliotti</i> , REDF.	Terr. Moll., V.	
<i>cerinoideus</i> , ANTH.	" "	
<i>cellarius</i> , MÜLL.	" "	
<i>Whitneyi</i> , NEWC.	" "	and this paper.
<i>nitidus</i> , MÜLL.	" "	
<i>arboreus</i> , SAY.	" "	
<i>viridulus</i> , MÜLL.	" "	
<i>indentatus</i> , SAY.	" "	
<i>limatulus</i> , WARD.	" "	
<i>minusculus</i> , BINN.	" "	
<i>miliun</i> , MORSE.	" "	
<i>Binneyanus</i> , MORSE.	" "	
<i>ferreus</i> , MORSE.	" "	
<i>exiguus</i> , STIMPSON.	" "	
<i>placentula</i> , SHUTTL.	" "	
<i>fulvus</i> , DRAP.	" "	
<i>Gundlachi</i> , PFR.	" "	
<i>gularis</i> , SAY.	" "	
<i>suppressus</i> , SAY.	" "	
<i>lasmodon</i> , PH.	" "	
<i>significans</i> , BL.	" "	
<i>internus</i> , SAY.	" "	
<i>multidentatus</i> , BINN.	" "	
<i>Janulus bifrons</i> , LOWE.	See this paper.	
<i>stephanophora</i> , DESH.	See this paper.	

Holognatha Helicea.

(a.) JAW RIBLESS.

<i>Tebennophorus Caroliniensis</i> , BOSC.	Terr. Moll., V.	
<i>Costaricensis</i> , MÖRCH?	Ann. N. Y. Acad. Nat. Sc., I. 261.	
<i>Sagda connectens</i> , AD.	Am. Journ. Conch., VII. 175.	
<i>Haldemaniana</i> , AD.	Am. Journ., VII. 175; Phila. Proc., 1874, 55.	
<i>Jayana</i> , AD.	Ann. Lyc., X. 219.	
<i>Endodonta tumuloides</i> , GARRETT.	Phila. Proc., 1875, 248.	
<i>incerta</i> , MOUSSON.	Ann. Lyc., XI. 171.	
<i>Microphysa</i> .	See below.	
<i>Patula Huahinensis</i> , PFR.	Ann. Lyc., XI. 171.	
<i>solitaria</i> , SAY.	Terr. Moll., V.	
<i>strigosa</i> , GLD.	" "	
var. <i>Cooperi</i> .	" "	
<i>Haydeni</i> .	" "	
<i>Newcombi</i> .	" "	
<i>Hemphilli</i> , NEWC.	" "	
<i>Idahoensis</i> , NEWC.	" "	

- Patula alternata*, SAY. Terr. Moll., V.
 var. *mordax*. " "
 Cumberlandiana, LEA. " "
 perspectiva, SAY. " "
 striatella, ANTHONY. " "
 asteriscus, MORSE. " "
- Polymita muscarum*, LAG. Am. Journ. Conch., VI. 204.
 picta, BORN. Ann. Lyc., X. 341.
- Hemitrochus gallopavonis*, VAL. Ann. Lyc., X. 342.
 Troscheli, PFR. " X. 343.
 rufoplicata, POEY. " XI. 26.
 graminicola, AD. Am. Journ. Conch., VII. 178; Phila. Proc., 1874, 56.
 varians, MKE. Terr. Moll., V.
 Milleri, PFR. See this paper.
- Helicodiscus lineatus*, SAY. Terr. Moll., V.
- Acavus Phœnix*, PFR. Am. Journ. Conch., VII. 180; Phila. Proc., 1874, 58.
- Caraculus excellens*, PFR. " " " " " " "
 sagemon, BECK. Phila. Proc., 1875, 249; 1876, 188.
 marginella, GMEL. " 1874, 51.
 Arangiana, POEY. " 1875, 250.
- Leucochroa Boissieri*, CHARP. Ann. Lyc., X. 220; Phila. Proc., 1874, 55.
- Ochtheiphila abjecta*, LOWE. See this paper.
 tiarella, W. & B. See this paper.
- Cysticopsis pemphigodes*, PFR. Am. Journ. Conch., VII. 177; Phila. Proc., 1874, 56.
 tumida, PFR. Ann. Lyc., IX. 283; Am. Journ. Conch., VI. 203.
- Plagioptycha loxodon*, PFR. Am. Journ. Conch., VII. 177.
 diaphana, LAM. " " " 178.
 Albersiana, PFR. " " " 178.
 macroglossa, PFR. Phila. Proc., 1874, 56; Am. Journ. Conch., VII. 178.
 monodonta, PFR. Am. Journ. Conch., VII. 178.
 Duclosiana, FÉR. See this paper.
- Leptoloma fuscocincta*, AD. Am. Jour. Conch., VII. 180; Phila. Proc., 1874, 58.
- Achatinella*. Ann. Lyc., X. 331.
 picta, MGHLS. Ann. Lyc., X. 331.
 jucunda, SMITH. " "
 Mastersi, NEWC. " "
 nitida, NEWC. " "
 grana, NEWC. " "
 plumbea, GULICK. " "
 eburnea, GULICK. " "
 solidissima, SMITH. " "
 livida, SWAIN. " "

- Achatinella decorticata*, GUL. Ann. Lyc., X. 331.
luctuosa, PFR. " "
nigrolabris, SM. " "
dimidiata, PFR. " "
solida, GUL. " "
tæniolata, PFR. " "
varia, GUL. " "
producta, RVE. " "
Johnsonii, NEWC. " "
marmorata, GLD. " XI. 190.
textilis, FÉR. " "
obesa, NEWC. " "
venusta, MGHLS. " "
auricula, FÉR. " "
 (representing s. g. *Achatinella*, *Bulimella*, *Apex*, *Partulina*, *Auricul-
 ella*, *Laminella*, *Amastra*, *Leptachatina*, of Gulick. For *Carelia*,
 see below. *Newcombia* not examined.)
- Tornatellina aperta*, PSE. Ann. Lyc., XI. 189.
oblonga, PSE. " "
- Clausilia tridens*, CH. Am. Journ. Conch., VII. 28.
- Stenogyra gonostoma*, GUNDL. " " " 183.
octona, CHEMN. " " " 183.
hasta, PFR. Phila. Proc., 1875, 251.
juncea, GLD. Ann. Lyc., XI. 186.
decollata, LINN. Terr. Moll., V.
subula, PFR. " "
- Strophia incana*, BINN. " "
decumana, FÉR. Ann. Lyc., X. 348; Phila. Proc., 1874, 53.
mumia, BRUG. " X. 348.
iostoma, PFR. " XI. 31.
- Pupa muscorum*, L. Terr. Moll., V.
pentodon, S. " "
fallax, S. " "
rupicola, S. " "
corticaria, S. " "
- Vertigo Gouldi*, BINN. " "
Bollesiana, MORSE. " "
ovata, S. " "
ventricosa, MORSE. " "
- Ferussacia subcylindrica*, LIN. Terr. Moll., V.
Cionella Gloynei, GIBBONS. See this paper.
Cæcilianella Gundlachi, PFR. Ann. Lyc., XI. 185.
Holospira Goldfussi, MKE. Terr. Moll., V.
Lithotis rupicola, BLANDFORD. Ann. Lyc., X. 346; Phila. Proc., 1874, 54.
Limicolaria Numidica, RVE. Am. Journ. Conch., VII. 181.

(b.) JAW WITH DECIDED STOUT RIBS.

- Anadenus* ———. Ann. Lyc., XI. 180.
- Arion fuscus*, MÜLL. Terr. Moll., V.
- Geomalacus maculosus*, ALLM. Ann. Lyc., X. 308; XI. 31.
- Ariolimax Columbianus*, GLD. Terr. Moll., V.
- Californicus*, J. G. C. " "
- niger*, J. G. C. " "
- Hemphilli*, W. G. B. " "
- Andersoni*, W. G. B. " "
- Prophysaon Hemphilli*, BL. & BINN. " "
- " var. " "
- Pallifera dorsalis*, BINN. " "
- Wetherbyi*, W. G. B. " "
- Veronicella occidentalis*, GUILD. Ann. Lyc., X. 339; Am. Jour. Conch., VII. 163.
- Same.
- Same.
- Floridana*, BINN. Terr. Moll., V.
- ? Ann. N. Y. Acad. Nat. Sc., I. 262.
- ? See this paper.
- olivacea*, STRNS. See this paper.
- Simpulopsis corrugatus*, GUPPY. See this paper.
- Binneya notabilis*, J. G. C. Terr. Moll., V.
- Cryptostrakon Gabbi*, W. G. B. Ann. N. Y. Acad. Nat. Sc., I. 260.
- Hemphillia glandulosa*, BL. & BINN. Terr. Moll., V.
- Microphysa circumfirmata*, REDE. Ann. Lyc., X. 221. (= *Sagda* ?)
- turbiniiformis*, PFR. " X. 79; Phila. Proc., 1874, 55.
- Stearnsi*, BL. See this paper.
- Lansingi*, BL. Terr. Moll., V.
- incrustedata*, POEY. " "
- vortex*, PF. " "
- Ingersolli*, BL. " "
- Gonostoma Yatesi*, J. G. C. " "
- Polygyra microdonta*, DESH. Am. Journ. Conch., VI. 205.
- auriculata*, S. Terr. Moll., V.
- uvulifera*, SH. " "
- auriformis*, BL. " "
- Postelliana*, BL. " "
- espiloca*, RAV. " "
- avara*, S. " "
- ventrosula*, PF. " "
- Texasiana*, MOR. " "
- triodontoides*, BL. " "
- Mooreana*, W. G. B. " "
- fatigans*, L. W. SAY. " "

<i>Polygyra Troostiana</i> , LEA.	Terr. Moll., V.	
<i>Hazardi</i> , BL.	"	"
<i>oppilata</i> , MOR.	"	"
<i>Dorfeuilliana</i> , LEA.	"	"
<i>septemvolva</i> , S.	"	"
<i>cereolus</i> , MUHLF.	"	"
<i>Carpenteriana</i> , BL.	"	"
<i>Febigeri</i> , BL.	"	"
<i>pustula</i> , FÉR.	"	"
<i>pustuloides</i> , BL.	"	"
<i>leporina</i> , GLD.	"	"
<i>Polygyrella polygyrella</i> , BL. & C.	"	"
<i>Strobila labyrinthica</i> , SAY.	"	"
<i>Hubbardi</i> , A. D. B.	"	"
<i>Stenotrema spinosum</i> , LEA.	"	"
<i>labrosum</i> , BL.	"	"
<i>Edwardsi</i> , BL.	"	"
<i>barbigerum</i> , REDF.	"	"
<i>stenotremum</i> , FÉR.	"	"
<i>hirsutum</i> , SAY.	"	"
<i>monodon</i> , R.	"	"
<i>germanum</i> , GLD.	"	"
<i>Triodopsis palliata</i> , S.	"	"
<i>obstricta</i> , S.	"	"
<i>appressa</i> , S.	"	"
<i>inflecta</i> , S.	"	"
<i>Rugeli</i> , SH.	"	"
<i>tridentata</i> , S.	"	"
<i>Harfordiana</i> , J. G. C.	"	"
<i>introferens</i> , BL.	"	"
<i>Hopetonensis</i> , SH.	"	"
<i>Van Nostrandii</i> , BL.	"	"
<i>vultuosa</i> , GLD.	See this paper.	
<i>loricata</i> , GLD.	Terr. Moll., V.	
<i>Mesodon major</i> , BINN.	"	"
<i>albolabris</i> , S.	"	"
<i>divesta</i> , G.	"	"
<i>multilineata</i> , S.	"	"
<i>Pennsylvanica</i> , GREEN.	"	"
<i>Mitchelliana</i> , LEA.	"	"
<i>elevata</i> , S.	"	"
<i>Clarki</i> , LEA.	"	"
<i>Christyi</i> , BL.	"	"
<i>exoleta</i> , BINN.	"	"
<i>Wheatleyi</i> , BL.	"	"
<i>dentifera</i> , BINN.	"	"

- Mesodon Roemeri*, PFR. Terr. Moll., V.
Wetherbyi, BL. " "
thyroides, S. " "
bucculenta, G. " "
clausa, S. " "
Columbiana, LEA. " "
Downieana, BL. " "
Mobiliana, LEA. " "
devia, G. " " and this paper.
Mullani, BL. " "
profunda, S. " "
Sayii, BINN. " "
" var. *Chilhoweensis*. See this paper.
- Acanthinula harpa*, SAY. Terr. Moll., V.
Vallonia pulchella, MÜLL. " "
Fruticicola rufescens, PENN. " "
hispida, LINN. " "
pubescens, PFR. Ann. Lyc., XI. 172.
- Dorcasia pyrozoona*, PHIL. Phila. Proc., 1875, 251.
similaris, FÉR. Am. Journ. Conch., VII. 176; Phila. Proc., 1874, 55.
griseola, PFR. Terr. Moll., V.
- Turricula terrestris*, CH. " "
tuberculosa, CONR. Phila. Proc., 1876, 187.
- Tectula lincta*, LOWE. See this paper.
- Aglaja fidelis*, GRAY. Terr. Moll., V.
infumata, GLD. " "
- Arionta arrosa*, GLD. " "
Townsendiana, LEA. " "
tudiculata, BINN. " "
Nickliniana, LEA. " "
Ayersiana, NEWC. " "
redimita, W. G. B. " "
intercisa, W. G. B. " "
Kelletti, FBS. " "
Stearnsiana, GABB. " "
exarata, PFR. " "
ramentosa, GLD. " "
Californiensis, LEA. " "
Carpenteri, NEWC. " "
Mormonum, PFR. " "
sequoicola, J. G. C. " "
Diabloensis, J. G. C. " "
Traski, NEWC. " "
Dupetithouarsi, DESH. " "
intercisa, W. G. B. See this paper.
ruficincta, NEWC. Terr. Moll., V.

- Arionta Gabbi*, NEWC. Terr. Moll., V.
Glyptostoma Newberryanum, W. G. BINN. " "
Euparypha Tryoni, NEWC. " "
Tachea hortensis, MÜLL. " "
Coryda Gossei, PFR. Am. Journ. Conch., VII. 177; Phila. Proc., 1874, 55.
Plebecula lurida. See this paper.
Leptaxis undata, LOWE. See this paper.
Pomatia aspersa, MÜLL. Terr. Moll., V.
 Sieboldiana, PHIL. Phila. Proc., 1875, 250.
 Humboldtiana, VAL. See this paper.
Thelidomus provisorio, PFR. Ann. Lyc., X. 347; Phila. Proc., 1874, 51.
 discolor, FÉR. " XI. 27; " " 56.
 aspera, FÉR. " XI. 173; Am. Journ. Conch., VI. 204.
 Jamaicensis, CHEMN. " XI. 173.
 notabilis, SHUTTL. Phila. Proc., 1874, 50; Am. Journ. Conch.,
 lima, FÉR. Phila. Proc., 1874, 51. [VII. 177.
 auricoma, FÉR. " 1875, 248.
 Arangiana, POEY. " " 250.
Eurycratera angulata, FÉR. " 1874, 50.
 crispata, PFR. Phila. Proc., 1874, 50; Am. Journ. Conch., VII.
 179; Ann. Lyc., XI. 174.
Polydotes Luquillensis, SHUTTL. Phila. Proc., 1874, 50.
Stylodon Studeriana, FÉR. Ann. Lyc., XI. 172.
Dentellaria dentiens, PFR. " XI. 173; Am. Journ. Conch., VII. 179.
 pachygastra, GR. " X. 305.
 Josephinae, FÉR. " X. 306; XI. 27.
 punctata, BORN. Phila. Proc., 1874, 52.
 nucleola, RANG. Ann. Lyc., XI. 27; Phila. Proc., 1874, 52.
 formosa, FÉR. Phila. Proc., 1874, 52.
 badia, FÉR. " " 52; Ann. Lyc., XI. 26.
 nuxdenticulata, CHEMN. Ann. Lyc., XI. 26.
 lychnuchus, MÜLL. " X. 301.
 orbiculata, FÉR. Am. Journ. Conch., VI. 305.
 Isabella, FÉR. " " VII. 179.
 perplexa, FÉR. Ann. Lyc., X. 221.
Pleurodonta invalida, AD. " " 306.
 Chemnitziana, PFR. Phila. Proc., 1874, 51.
 Carmelita, FÉR. " "
 Schroeteriana, PFR. Am. Journ. Conch., VII. 179.
 acuta, LAM. " " VI. 204.
Merope fringilla, PFR. Ann. Lyc. XI. 175.

Incertæ Sedis.

- Helix astur*, SOUV. Phila. Proc., 1875, 248.
 convicta, COX. " " 251.

Helix ——— ? Ann. N. Y. Acad. Nat. Sc., I. 261.

Carelia bicolor, JAY. Phila. Proc., 1876, 185.

Macrodonates odontostomus, SOWB. Am. Journ. Conch., VI. 209; Phila. Proc., 1874, 58.

Pelocychilus auris Sileni, BORN. Ann. Lyc., XI. 33; X. 222; Phila. Proc., 1874, 58.

glaber, GMEL. Phila. Proc., 1874, 58; Ann. Lyc., XI. 33.

Anthinus multicolor, RANG. Am. Journ. Conch., VI. 203; Phila. Proc., 1874, 58.

Pachyotus egregius, JAY. Phila. Proc., 1874, 58.

Borus oblongus, MÜLL. Am. Journ. Conch., VII. 180.

Orphnus foveolatus, RVE. Ann. Lyc., XI. 32.

magnificus, GRAT. Am. Journ. Conch., VI. 208.

Hanleyi, PFR. Phil. Proc., 1874, 59; Am. Journ. Conch., VI. 208.

Dryptus pardalis, FÉR. Am. Journ. Conch., VII. 181.

marmoratus, DUNKER. Phila. Proc., 1874, 59; Am. Journ. Conch., VII. 181.

Eurytus aulacostylus, PFR. Ann. Lyc., X. 222; Phila. Proc., 1874, 59.

Canistrum fulgetrum, BROD. Am. Jour. Conch., VII. 180; Phila. Proc., 1874, 59.

(c.) JAW WITH SEPARATE DELICATE RIBS, USUALLY RUNNING OBLIQUELY TOWARDS THE CENTRE.

Gæotis. Ann. Lyc., X. 252.

Amphibulima patula, BRUG. Ann. Lyc., X. 225; Phila. Proc., 1874, 44.

appendiculata, PFR. " " 343, 206; " " 42.

rubescens, DESH. " " 345; " " 45.

Rawsonis, BLAND. " XI. 187.

Drymæus altoperuvianus, RVE. " " 33.

Vincentinus, PFR. Phila. Proc., 1874, 53.

Knorri, PFR. " " "

Lobbi, RVE. Ann. Lyc., XI. 35.

Bahamensis, PFR. " X. 82.

Rawsonis, H. AD. (*aureolus* var. *Rawsonis*.) Am. Journ. Conch., VII. 181.

Liostracus multifasciatus, LAM. Ann. Lyc., X. 305.

alternans, BECK. " "

Marielinus, POEY. Terr. Moll., V.

Dormani, W. G. B. " "

Mesembrinus primularis, RVE. Ann. Lyc., XI. 37; IX. 282.

pallidior, SOWB. " XI. 180; "

chrysalis, PFR. Phila. Proc., 1874, 53.

Thaumastus alternatus, SAY. Terr. Moll., V.

Schiedeanus, PFR. " " and this paper.

immaculatus, AD. See this paper.

Mormus membranaceus, PHIL. Am. Journ. Conch., VII. 182.

laticinctus, GUPPY. Ann. Lyc., X. 81.

- Mormus sufflatus*, GLD. Am. Journ. Conch., VI. 209.
Jonasi, PFR. Am. Journ. Conch., VII. 182.
Scutalus rhodolarynx, RVE. Ann. Lyc., XI. 36.
proteus, SOWB. " XI. 37.
dealbatus, SAY. Terr. Moll., V.
Leptomerus limnæoides, FÉR. Ann. Lyc., XI. 186.
sepulcralis, POEY. " X. 347.
corneus, (*Berendti*). Am. Journ. Conch., VII. 182.
Rhinus durus, SPIX. " " "
Plectostylus Peruvianus, BRUG. Phila. Proc., 1874, 53; Ann. Lyc., XI. 35.
Bulimulus (subgenus unknown to me).
Edwardsi, MOREL. Phila. Proc., 1876, 101.
Irazuensis, ANGAS. Ann. N. Y. Ac. Nat. Sc., I. 262. (= Gabbianus.)
Cylindrella elegans, PFR. Phila. Proc., 1875, 251.
cyclostoma, PFR. " " 252.
Humboldti, PFR. " " 252.
ornata, GUNDL. Ann. Lyc., XI. 187.
subula, FÉR. Am. Journ. Conch., VII. 183.
seminuda, AD. " " VII. 184.
rosea, PFR. " " V. 37.
Poeyana, D'ORB. Terr. Moll., V.
Chemnitziana, FÉR. See this paper.
sanguinea, PFR. Ann. Lyc., XI. 34.
brevis, PFR. " "
Macroceramus Gossei, PFR. Terr. Moll., V.
turricula, PFR. Phila. Proc., 1875, 251.
inermis, GUNDL. See this paper.
Pineria Viequensis, PFR. Ann. Lyc., X. 26.
Partula (numerous species). Phila. Proc., 1875, 244; Ann. Lyc., XI. 45.

Elasmognatha.

- Omalyonx felina*, GUPPY. Ann. Lyc., X. 346, and this paper.
Succinea pallida, PFR. " XI. 189.
papillata, PFR. " "
canella, GLD. " X. 338.
Barbadensis, GUILD. Phila. Proc., 1874, 54.
Haydeni, W. G. B. Terr. Moll., V.
Sillimani, BL. " "
ovalis, GLD., not SAY. " "
Concordialis, GLD. " "
lineata, W. G. B. " "
avara, SAY. " "
Stretchiana, BL. " "
Verrilli, BL. " "
obliqua, SAY. " "
Totteniana, LEA. " "

- Succinea campestris*, SAY. Terr. Moll., V.
Nuttalliana, LEA. " "
effusa, SH. " "
sagra, D'ORB. Am. Journ. Conch., VII. 184.

Goniognatha.

- Orthalicus obductus*, SHUTTL. Ann. Lyc., XI. 40.
gallina sultana, CHEMN. " XI. 38.
undatus, BRUG. Terr. Moll., V.
zebra, MÜLL. Am. Journ. Conch., VI. 212. (= *melanocheilus*, VAL.)
Liguus virgineus, LIN. " " VI. 209; Ann. Lyc., XI. 41.
fasciatus, MÜLL. Terr. Moll., V.

PULMONATA LIMNOPHILA.

- Melampus bidentatus*, SAY. Ann. Lyc. N. H. of N. Y., IX. 286.
Alexia myosotis, DR. L. & Fr. W. Sh. N. A., II. 1.
Carychium exiguum, SAY. " " " 6.
Limnæa appressa, SAY. Am. Journ. Conch., VII. 161; L. & Fr. W. Sh., II. 28.
stagnalis, L. L. & Fr. W. Sh., II. 155.
megasoma, SAY. Am. Journ. Conch., VII. 162.
columella, SAY. L. & Fr. W. Sh. N. A., II. 24.
catascopium, SAY. " " " 55.
Pompholyx effusa, Lea. Am. Journ. Conch., VI. 312.
Physa vinosa, GLD. L. & Fr. W. Sh. N. A., II. 81.
ancillaria, SAY. " " " II. 83.
Physa ——. Ann. Lyc., X. 255.
Planorbis trivolis, SAY. Ann. Lyc., IX. 292.
Ancylus Newberryi, LEA. L. & Fr. W. Sh. N. A., II. 22.
Erinna Newcombi, A. AD. Ann. Lyc., X. 349; Phila. Proc., 1874, 54.
Gundlachia Californica, ROWELL. L. & Fr. W. Sh. N. A., II. 148.

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- Geomelania*. Am. Journ. Conch. VII. 185.
Blandiella reclusa, GUPPY. " " "
Megalomastoma bituberculatum, SOWB. Am. Journ. Conch., VI. 213.
Tulotoma magnificum, CONRAD. Ann. Lyc., IX. 293.
Pomus depressa, SAY. L. & Fr. W. Sh., III. 1.
Vivipara intertexta, SAY. " " III. 16.
Melantho integra, SAY. " " III. 35.

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- Neritella reclinata*, SAY. L. & Fr. W. Sh., III. 101.
Stoastoma pisum, AD. Am. Journ. Conch., VII. 184.
Helicina occulta, SAY. Ann. Lyc., IX. 287; Am. Journ. Conch., VII. 29.
 ——. L. & Fr. W. Sh., III. 116.
orbiculata, SAY. Am. Journ. Conch., VI. 214.

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43. On the Lingual Dentition of Certain Terrestrial Mollusca, foreign to the United States (in connection with Mr. BLAND), from same as last, Dec. 1872, pp. 219-225 (actually distributed Jan. 1873) 253
44. On the Lingual Dentition of *Gæotis* (in connection with Mr. BLAND), from same as last, pp. 252-254, Pl. XI., Jan. 1873 (actually distributed in March) 260
45. Note on a Curious Form of Lingual Dentition in *Physa* (in connection with Mr. BLAND), from same as last (distributed with last), pp. 255-257, Pl. XI. 265
46. On the Lingual Dentition and Jaw of Certain Terrestrial Pulmonata from the United States, with Remarks on their Systematic Value (in connection with Mr. BLAND), from Proc. Phila. Acad. Nat. Sci., 1873 (actually distributed in June), pp. 240-256, Pl. VII. 270
47. On *Prophysaon*, a new Pulmonate Mollusk, on *Ariolimax*, on *Helix lychnuchus*, and other species (in connection with Mr. BLAND), from Annals of Lyceum of Nat. Hist. of New York, X., pp. 293-311, Pl. XIII., XIV., 1873 (actually distributed in August) 289
48. Catalogue of the Terrestrial Air-breathing Mollusks of North America, with Notes on their Geographical Range, from Bulletin of Museum of Comparative Zoölogy, Vol. III., No. 9, 1873, pp. 191-220, with a Map (actually distributed in October) 313
49. On the Lingual Dentition and Anatomy of *Achatinella*, and other Pulmonata (in connection with Mr. BLAND), from same as No. 47, pp. 331-351, Pl. XV., XVI., 1873 (actually distributed February, 1874) 345
50. Title-page and Table of Contents to Notes, etc., Vol. I., 1874 i

Vol. II. of my "Notes" contains the following (date of title and index, 1876):—

PART I.

No. 51. On the Anatomy and Lingual Dentition of *Ariolimax* and other Pulmonata; from Proceedings of the Academy of Natural Sciences of Philadelphia, 1874, pp. 33-63, Pl. II.-XI. (actually distributed May, 1874).

PART II.

No. 52. On the Genitalia and Lingual Dentition of Pulmonata, from the Annals of the Lyceum of Natural History of New York, Vol. XI., June, 1874, pp. 20-46, Pl. I.-VI. (actually distributed Sept., 1874).

PART III.

No. 53. On the Jaw and Lingual Dentition of North American Terrestrial Pulmonata, from same as Part I., 1875, pp. 140-243, Pl. I.-XVIII. (actually distributed Sept., 1875).

No. 54. On the Lingual Dentition and Genitalia of *Partula* and other Pulmonata, from same as last, pp. 244-254, Pl. XIX.-XXI. (distributed with the last).

PART IV.

No. 55. On the Genitalia, Jaw, and Lingual Dentition of Certain Species of Pulmonata, from same as No. 52, Vol. XI. pp. 166-196, Pl. XII.-XVIII., October, 1875 (actually distributed March, 1876).

Vol. III of my "Notes" has thus far only the following :—

56. On the Lingual Dentition, Jaw, and Genitalia of Carelia, Onchidella, and other Pulmonata, from the Proceedings of the Philadelphia Academy of Natural Sciences, 1876, pp. 183-192, Pl. VI.
57. On the Land Shells of the Mexican Island of Guadelupe, collected by Dr. E. Palmer, from same, 1879, p. 16.
58. On the Jaw and Lingual Dentition of certain Costa Rica Land Shells, collected by Dr. W. M. Gabb, from Annals of New York Academy of Sciences, Vol. I. pp. 257-262, Pl. XI., 1879.
59. This paper.

In addition to the above papers, I have published the following articles, of which extra copies have not been distributed :—

60. Note on *Helix thyroides*, Proc. Boston Soc. Nat. Hist., April, 1857, VI, 128, 129.
61. Descriptions of two supposed new species of American Land Shells, from same, Vol. VI. pp. 155, 156, 1857.
62. Note on Geographical Distribution of North American Land Shells, from same, Vol. IX. pp. 177, 1863.
63. On Lingual Dentition studied by the Microscope and Photography, from American Journal of Conchology, Vol. V. pp. 37, 38, Pl. XI., 1869, with a note by Mr. BLAND.
64. Notes sur quelques espèces de mollusques fluviatiles de l'Amérique du Nord. From Journal de Conchologie, Vol. XX. (3d series, Vol. VII.) Paris, 1867, pp. 427-432.

65. Catalogue of Land Shells, p. 725. From Explorations in Nebraska. Preliminary Report of Lieut. G. K. Warren, Top. Eng., etc. Dr. F. V. Hayden's Report on Geology and Natural History. From Executive Documents, printed by order of the House of Representatives, during the Second Session of the 35th Congress, 1858-59, Vol. II. Part III. pp. 723. Washington, 1859.
66. Report on the Land Shells collected on the Survey, from Reports of Explorations and Surveys to ascertain the most practicable and economical Route from the Mississippi River to the Pacific Ocean, made under the direction of the Secretary of War, in 1854-5, Vol. VI. pp. 111-114. Washington, 1857.
67. The Terrestrial Air-breathing Mollusks of the United States, Vol. IV. pp. 207, and six colored Plates, forming also Part I. of Vol. VII. of the Boston Journal of Natural History. Westermann & Co., New York, 1859. — The same, Vol. V., pp. 449, sixteen new plates, and plates of Vol. III. reproduced. Published as Bulletin of the Museum of Comparative Zoölogy at Cambridge, Mass., Vol. IV., July, 1878.
68. Land and Fresh-water Shells of North America. Part II. Pulmonata Limnophila and Thalassophila, pp. 161 and wood-cuts, from Smithsonian Miscellaneous Collections. Washington, 1865.
69. Part III. of same : Ampullariidæ, Valvatidæ, Viviparidæ, Fresh-water Rissoidæ, Cyclophoridæ, Truncatellidæ, Fresh-water Neritidæ, Helicinidæ, pp. 120 and wood-cuts, 1865.
70. Part I of same : Pulmonata Geophila (in connection with Mr. BLAND), pp. 316 and wood-cuts, 1869.
71. Report on the Invertebrata of Massachusetts, by A. A. Gould, M. D. Second Edition. Boston, 1870, pp. 524, wood-cuts, and eleven colored plates.
72. The Complete Writings of THOMAS SAY on the Conchology of the United States. New York, H. Baillière, 1858, pp. 252, 74 plates. The "Descriptions of Terrestrial Shells of North America" were published separately in 1856. Philadelphia, Childs & Peterson, pp. 40.
73. The Complete Writings of CONSTANTINE SMALTZ RAFINESQUE, on Recent and Fossil Conchology (in connection with G. W. TRYON, Jr.). New York, Ballière Bros., 1864, pp. 96, wood-cuts and 3 plates.
74. The Bibliography of North American Conchology, previous to the year 1860. From Smithsonian Miscellaneous Collections. Washington, Part I., pp. 650, 1863.
75. The same, Part II., pp. 298, 1864.

EXPLANATION OF THE PLATES.

Plate I.

- Fig. A. Lingual dentition of *Hemitrochus Milleri*, Pfr.
 Fig. B. Jaw of same.
 Fig. C. Lingual dentition of *Plagioptycha Duclosiana*, Fér.
 Fig. D. " " *Bulimulus immaculatus* ; *b*, a marginal tooth.
 Fig. E. " " *Leptaxis undata*, Lowe.
 Fig. F. " " *Bulimulus Schiedeanus*, Pfr.
 Fig. G. " " *Simpulopsis corrugatus*, Guppy.
 Fig. H. " " *Cionella Gloynei*, Gibbons.
 Fig. I. " " *Zonites Whitneyi*, Newc.
 Fig. J. " " *Omalonyx felina*, Guppy.
 Fig. K. " " *Mesodon Chilhoweensis*, Lewis.
 Fig. L. " " *Plebecula lurida*, Lowe.
 Fig. M. " " *Microphysa Stearnsi*, Bl.
 Fig. N. Jaw of same.

Plate II.

- Fig. A. *Chlamydephorus Gibbonsi*.
 Fig. B. " " lingual dentition.
 Fig. C. *Triodopsis vultuosa*, Gld., lingual dentition.
 Fig. D. *Urocyclus Kirki*, Gray, jaw.
 Fig. E. " " " lingual dentition.
 Fig. F. *Hemphillia glandulosa*.
 Fig. G. Genitalia of *Mesodon devia*, Gld. ; *a*, penis sac ; *b*, genital bladder and duct.
 Fig. H. *Vitrinizonites latissimus*, Lewis, lingual dentition.
 Fig. I. Genitalia of *Mesodon Sayii*, var. *Chilhoweensis*.
 Fig. J. Genitalia of *Pomatia Buffoniana*, Val.
 o. ovary.
 a. accessory gland.
 e. epididymis.
 ov. oviduct.
 v. d. vas deferens.
 g. b. genital bladder.
 pr. prostate gland.
 p. s. penis sac.
 or. external orifice.

APPENDIX.

Arionta intercisa, W. G. BINN. Mr. Henry Hemphill has lately sent me alcoholic specimens of this species, collected by him at San Clemente Island, California.

The jaw is as usual in the genus, with six separated ribs.

The lingual membrane is as usual in the genus. Teeth 31-1-31, with about 15 laterals on each side. The extreme laterals only are bicuspid.

The genitalia are like those figured by me for *Euparypha Tryoni*. (See Terr. Moll. U. S., V.)

From the series of specimens sent by Mr. Hemphill, I am inclined to believe *Arionta redimita* to be a variety of *intercisa*. The original specimen may have come from the same locality. Formerly I suspected *redimita* to be a variety of *ramentosa*.

NOTE ON THE GENERA OF SLUGS.

Having had occasion to describe several genera of naked terrestrial mollusks, I add here, for the sake of comparison, a list of known genera with their generic characters, as far as they can be ascertained. It is difficult to draw the line between the slugs and the snails. I have not included *Succinea*, *Helisaga*, *Amphibulima* (*Pellicula*), *Vitrinopsis*, *Vitrinizonites*, which have some claim to be considered sublimaciform. I have included *Binneya* and *Laconia*, which should, perhaps, be considered as subheliciform.

AGNATHA.

Testacella, Cuv. Animal limaciform, subcylindrical, tapering anteriorly : tentacles simple : mantle small, posterior, quite near tail, covered with a small external shell : no longitudinal furrows above the margin of the foot, and no caudal mucus pore : no distinct locomotive disk : external respiratory and anal orifice at the posterior right edge of the mantle under peristome of the shell : combined generative orifice behind and below the right eye-peduncle.

Shell external, rudimentary, imperforate, ear-shaped, with a subspiral, posterior, umbona nucleus.

No jaw.

Lingual membrane with no central tooth ; others aculeate, apex hooked.

Eastern Europe, Teneriffe, Madeira.

For figure of animal and shell, see Moquin-Tandon, Moll. Terr. et Fluv. de la France.

For lingual dentition, see Heynemann, Malak, Blatt., X., Pl. II. Fig. 5.
The body is distinguished by two lateral grooves.

Daudebardia, HARTM. (*Helicophanta*, Fér.) Animal limaciform, subcylindrical, tapering anteriorly: tentacles simple: mantle small, posterior, quite near tail, covered with a small, external shell: longitudinal furrows above the margin of the foot? no caudal mucus pore: distinct locomotive disk? external respiratory and anal orifice at the posterior right margin of mantle, under the peristome of the shell: generative orifice?

Shell small, external, perforate, depressed: paucispiral, whorls rapidly increasing.

No jaw.

Lingual membrane without central teeth; other teeth all aculeate, apex simple.

Germany, Hungary, Switzerland, Northern Italy.

For figure of animal and shell, see H. and A. Adams, Gen. Rec. Moll.

For dentition, see Goldfuss, Naturh. Vereins der Preuss. Rheinl. und Westphalens, 1856, Pl. VI. Figs. C, C'.

For anatomy, see Fischer, Journ. de Conch., V. 13.

The body has two lateral and two dorsal grooves.

Vaginulus, STOL. (*Vaginula* and *Veronicella*, part, of authors.) Animal limaciform, subcylindrical, high on the back, slender and pointed at tail: tentacles bifid: mantle covering the whole back: no longitudinal furrows above the margin of the foot, and no caudal mucus pore: no distinct locomotive disk? external anal and respiratory orifice at the lower right side of the mantle, about two fifths of the length of the body distant from the front: generative orifices distinct, the female with the respiratory orifice as above described, the male orifice behind and below the right eye-peduncle.

No shell.

No jaw.

Lingual membrane short: teeth aculeate.

Cochin China, etc.

For a figure of the animal, see Voyage de la Bonite, Pl. 28, Figs. 4-7, *V. Tourannensis*. For a notice of the agnathous genus as restricted from *Veronicella*, see Stolicka, Journ. Asiatic Soc. Bengal, 2d series, Vol. XLII. No. CLXXXI. p. 33.

Chlamydephorus, W. G. BINN. Animal limaciform, subcylindrical, tapering anteriorly: tentacles simple? mantle covering the whole back, with an orifice on its upper surface, near the tail, with radiating granulations, and near the same point enclosing a shelly plate: longitudinal furrows above the margin of the foot, meeting over a caudal mucus pore: distinct locomotive disk? external respiratory and anal orifice at the opening on the back? generative orifice or orifices?

Shell-plate internal, flat, white, testaceous, heavy, subhexagonal, small.

No jaw.

Lingual membrane quite like that of *Glandina*; central teeth like marginals, but symmetrical; other teeth aculeate.

Natal Colony, Africa.

For figure of animal and dentition, see Bulletin of Museum of Comparative Zoölogy at Cambridge, Pl. II. Fig. A. *Ante*, p. 331.

Onchidium, BUCH. Animal limaciform, elongate-oval: tentacles wanting: mouth with lobate appendages: mantle coriaceous, tubercular, covering the whole back: no longitudinal furrows above the margin of the foot, nor caudal mucus pore: no distinct locomotive disk: external respiratory orifice under the right posterior margin of the mantle: anal orifice separate from the last, posterior: male external generative orifice under the right eye-peduncle; female orifice at posterior of under side of body.

No shell or shelly plate.

No jaw.

Lingual membrane broad: teeth different in shape from those of the terrestrial genera, arranged in very oblique rows; centrals tricuspid, side teeth all alike, bicuspid, inner cusp small, outer cusp larger, with a greatly produced, oblique, squarely truncated cutting point.

Bengal, West Indies, etc.

For figure of animal, see Genera of Recent Mollusca; of lingual dentition, see W. G. Binney, Ann. Lyc. Nat. Hist. of N. Y., X., Pl. XVI. Figs. 3-5.

This and the three following genera are marine, and are in many ways distinct from the rest of the *Geophila*.

Onchidella, GRAY. Animal ovate: other characters as in *Onchidium*, but mantle smooth or granular.

For figure of animal, see Genera of Recent Mollusca; of lingual dentition, see Binney, Terr. Moll. U. S., V., Pl. V. Fig. B.

Distribution world-wide?

Peronia, BLAINV. (*Onchis*, Fér., *Oncus*, Ag.) Animal elongate-ovate; like the last genus, but with arbusculiform tufts and tubercles on mantle.

For figure of animal, see Genera of Recent Mollusca; of lingual dentition, see Keferstein in Bronn's *Thierr.*, CII., Fig. 2.

Buchananina, LESSON. Like the last genus, but mantle smooth, with a large central tubercle and radiating striæ; oral appendages simple, subulate. Chili.

For figure of animal, see Genera of Recent Mollusca.

Lingual dentition — ?

HOLOGNATHA VITRINEA.

Limax, LINN. Animal attached its whole length to the foot, subcylindrical, tapering behind, bluntly truncated anteriorly: tentacles simple: mantle small, anterior, enclosing a shelly plate: no longitudinal furrows above the margin of the foot, nor caudal mucus pore: a distinct locomotive disk: external anal and

respiratory orifices at the right posterior margin of the mantle: orifice of combined generative organs behind and below the right eye-peduncle.

Shell-plate testaceous, thin, flat, longer than wide, with concentric striæ of increase, internal.

Jaw smooth, with median projection.

Lingual membrane long and narrow: central teeth tricuspid, laterals bicuspid, marginals aculeate, often bifid. Considerable variation is found in the dentition of the genus; the centrals and laterals are sometimes unicuspid.

Universally distributed.

For figures of animal, shelly plate, jaw, and lingual dentition, see Terr. Moll. U. S., V.

The following generic and subgeneric names have been suggested for species of *Limax*, founded mostly on peculiarities of the mantle, genitalia, and lingual dentition: *Eulimax*, *Agriolimax*, *Milax*, *Amalia*, *Lehmannia*, *Limacus*, *Krynckellus*, *Krynckia*, *Heynemannia*, *Plecticolimax*, *Hydrolimax*, *Lallemannia*, *Malino*, *Malinastrum*, *Gestroia*, *Chromolimax*, *Opilolimax*, *Stabilea*, *Malicolimax*, *Megapelta*, *Clytropelta*, *Ibycus*.

Parmacella, CUV. (*Cryptella*, Webb & Berth., *Girasia*, *Drusia*, Gray, part.) Animal limaciform, subcylindrical, swollen behind, gradually attenuated before: tentacles simple: mantle large, central, concealing the shell: no longitudinal furrows above the margin of the foot, and no caudal mucus pore: distinct locomotive disk? external respiratory and anal orifices at the right posterior margin of the mantle: orifice of combined generative organs behind and below the right eye-peduncle.

Shell small, testaceous, internal, rudimentary, subspiral, aperture very large, dilated anteriorly.

Jaw smooth, with a median projection.

Lingual membrane with tricuspid centrals, first laterals tricuspid also, marginals aculeate.

Around the Mediterranean, Canaries, Central Asia.

For figure of animal and jaw see Moquin-Tandon, Moll. Terr. et Fluv. de la France. For description of lingual dentition, see Semper, Phila. Arch., 89.

The young animal is entirely enclosed in the shell, which is furnished with a sort of operculum. As the animal grows, the operculum falls, the shell becomes covered with the mantle, and only increases at its outer margin like the simple shell-plate of *Limax*.

Tennentia, HUMB. Body limaciform, subcylindrical, attenuated behind: tentacles simple: mantle large, anterior, concealing the shell: longitudinal furrows above the margin of the foot, meeting over a linear caudal mucus pore: distinct locomotive disk: external respiratory and anal orifices on the right central margin of mantle: orifice of combined genital system behind and below the right eye-peduncle.

Shell internal, small, rudimentary, convex above, flat below, apex on right posterior side, recurved.

Jaw smooth, with median projection.

Lingual membrane with tricuspid centrals and laterals, and aculeate, bifid, marginals, in the typical species ; others vary.

Ceylon.

For figure of animal, jaw, and lingual dentition, see Humbert, Rev. et Mag., 1862, p. 428.

Mariella, Gray (1855), is by some considered identical, and, if so, its name will take precedence. Identical with this last is *Clypeidella*, Val. ms., and *Clypeicella*. *Viquesnelia*, Desh., is also considered identical. (*V. Atlantica*, Mor., has the pulmonary orifice posterior.)

Parmarion, FISCHER. (*Rigasia*, Gray.) Animal limaciform, subcylindrical, tapering behind : tentacles simple : mantle large, anterior, enclosing an internal shell-plate, which is partially exposed by a posterior opening : distinct locomotive disk ? longitudinal furrows above the margin of the foot and caudal mucus pore, over which is a horn-shaped process : external anal and respiratory orifices on the posterior right margin of mantle (see Von Martens's figure of *P. papillaris*) : orifice of combined genital system ?

Shell-plate internal, rudimentary, flat, with a side nucleus.

Jaw smooth, with median projection.

Lingual membrane with tricuspid centrals, bicuspid laterals, and aculeate, bifid marginals.

Java, India.

For figure of animal, see Von Martens, Preuss. Ost. Asien ; of jaw and lingual dentition, see Semper, Phil. Arch.

Urocyclus, GRAY. Animal limaciform, subcylindrical, blunt before, tapering behind : tentacles simple : mantle small, anterior, with a posterior opening, and concealing an internal shell-plate : longitudinal furrows above the margin of the foot and caudal mucus pore : a distinct locomotive disk : external respiratory and anal orifices on the right slightly anterior margin of the mantle : orifice of combined generative organs behind and below right eye-peduncle.

Shell-plate internal.

Jaw smooth, without median projection.

Lingual membrane with tricuspid centrals, bicuspid laterals, aculeate and bifid marginals.

Mozambique.

For figure of animal, see Ann. Nat. Hist., [3,] XV., 1865, p. 331 ; of jaw and lingual dentition, see Bull. Mus. Comp. Zoöl., ante, p. 333.

Nearly allied to *Parmarion* ; seems only to differ by the position of the respiratory orifice, and the want of a horn-shaped process to the caudal pore.

Dendrolimax, HEYNEM. Animal limaciform, subcylindrical, blunt before, tapering behind : tentacles simple : mantle small, anterior, concealing an internal shell-plate, perforated posteriorly : longitudinal furrows above the margin of the foot ? a caudal mucus pore, with overhanging, horn-shaped process : distinct locomotive disk : anal and respiratory orifices at anterior right edge of

mantle : orifice of combined genital system behind and below right eye-peduncle.

Shell-plate internal, suboval, slightly convex, small, with posterior nucleus and concentric lines of growth.

Jaw smooth, with median projection.

Lingual membrane with peculiarly shaped teeth, centrals tricuspid, laterals bicuspid, marginals aculeate, bicuspid.

Prince's Island.

For figure of animal contracted in spirits, jaw, and lingual dentition, see Heynemann, Malak, Blatt., XV., Pl. I.

The horn-shaped process only seems to distinguish it from *Urocyclus*, the position of the respiratory orifice from *Parmarion*. Dentition peculiar.

Vitrinoidea, SEMPER. Animal limaciform, swollen at its middle, slender and tapering behind : tentacles simple ? mantle large, anterior, covering the shell : no longitudinal furrows above the margin of the foot, and no caudal mucus pore : no distinct locomotive disk : external respiratory and anal orifices on right anterior margin of mantle : orifice of combined genital system behind and under right eye-peduncle.

Shell internal, paucispiral, transparent, globose, rudimentary.

Jaw smooth.

Lingual membrane with tricuspid central and lateral teeth, and tricuspid aculeate marginals.

Luzon.

For figure of animal and lingual dentition, see Semper, Phil. Arch.

HOLOGNATHA HELICEA.

Tebennophorus, BINN. (*Incilaria*, Bens., *Megimathium*, Van Has.) Animal limaciform, cylindrical, blunt before, slightly attenuated behind : tentacles simple : mantle covering the whole back : no longitudinal furrows above the margin of the foot, and no caudal pore : no distinct locomotive disk : external respiratory and anal orifices near the head, somewhat to the rear of the right eye-peduncle : orifice of combined genital system behind and below the right eye-peduncle.

Shell or shell-plate none.

Jaw smooth, with median projection.

Lingual membrane long and narrow, centrals and first laterals unicuspid, outer laterals bicuspid, marginal teeth quadrate.

Asia, North and Central America.

For figure of animal, jaw, and lingual dentition, see Terr. Moll. U. S., V.

Oopelta, HEYNEM. Body limaciform, subcylindrical, tapering behind : tentacles simple : mantle small, oval, more pointed behind : no longitudinal furrows above the margins of the foot, and no caudal mucus pore : no distinct locomotive disk : external respiratory and anal orifices on the right slightly anterior margin of the mantle : orifice of combined generative system behind and under the right eye-peduncle.

No internal shell-plate.

Jaw smooth, with a median projection.

Lingual membrane with tricuspid centrals, bicuspid laterals, quadrate marginals.

Java, Ceylon, Cape of Good Hope, Guinea.

For figure of lingual dentition, see Heynemann, Malak, Blatt., XIV., Pl. II.

Anadenus, HEYNEM. Animal limaciform, subcylindrical, tapering behind : tentacles simple : mantle anterior, concealing an internal shell-plate : no longitudinal furrows above the margin of the foot, and no caudal mucus pore : a distinct locomotive disk : external respiratory and anal orifices on the right posterior margin of the mantle ; orifice of the combined genital system behind and below the right eye-peduncle.

Internal shell-plate small, oval, flat, with posterior nucleus and concentric striæ.

Jaw with numerous ribs.

Lingual membrane with tricuspid centrals, bicuspid laterals, and quadrate marginals.

Himalaya Mountains.

For figure of shell-plate and lingual dentition, see Heynemann, Malak, Blatt., X., Pl. I.

Arion, FER. (*Prolepis*, *Lochea*, *Baudonia*, *Kobeltia*.) Animal limaciform, subcylindrical, attenuated behind : tentacles simple : mantle small, anterior, concealing calcareous grains, sometimes agglomerated into a shelly plate : longitudinal furrows above the margins of the foot, meeting over a caudal mucus pore : a distinct locomotive disk : exterior respiratory and anal orifices on the anterior right margin of the mantle ; orifice of the combined genital system below the last.

Internal calcareous grains, in some species forming an imperfect shell-plate.

Jaw ribbed.

Lingual membrane with tricuspid central teeth, tricuspid or bicuspid laterals, and quadrate marginals.

Europe.

For figure of animal, jaw, and lingual dentition, see Terr. Moll. U. S., V.

Ariolimax, MÖRCH. Animal limaciform, subcylindrical, tapering behind : tentacles simple : mantle anterior, small, concealing an internal shell-plate : longitudinal furrows above the margin of the foot, meeting over a caudal mucus pore : a distinct locomotive disk : external respiratory and anal orifices on the posterior right margin of the mantle : orifice of combined genital system on the right side of the body, below the anterior free edge of the mantle.

Shell-plate internal, solid, flat, longer than wide.

Jaw ribbed.

Lingual membrane with tricuspid centrals, bicuspid laterals, and quadrate marginals.

Pacific Coast of United States.

Prophysaon, BLAND & BINN. Animal limaciform, subcylindrical, tapering behind: tentacles simple: mantle small, anterior, concealing a shell-plate: no longitudinal furrows above the margin of the foot, and no caudal mucus pore: no distinct locomotive disk: external respiratory and anal orifices on the right anterior margin of the mantle; orifice of combined genital system behind and below the right eye-peduncle.

Internal shell-plate thick, small, flat, longer than wide.

Jaw ribbed.

Lingual membrane with tricuspid centrals, bicuspid laterals, and quadrate marginals.

Pacific Coast of United States.

Pallifera, MORSE. Same as *Tebennophorus*, but with ribbed jaw.

In *Hemitrochus* and *Dentellaria* the presence or absence of ribs on the jaw is surely not a generic character. It may be, therefore, that *Pallifera* is identical with *Tebennophorus*.

Veronicella, BLAIN. (*Vaginula*, Fér., not *Vaginulus*, Stolicska, q. v.) Animal limaciform, elongate-ovate, rounded above, flat below, margins expanded: tentacles bifid, unequal, contractile: mantle covering the whole back: no longitudinal furrows above the margin of the foot, and no caudal mucus pore: no distinct locomotive disk: external respiratory orifice connecting with a tube to the anal orifice at the extreme posterior under part of the animal; orifice of male genital organ at the base of the right tentacle, of the female organs at the middle of the right under-side of the animal.

No internal shell or plate.

Jaw with numerous ribs.

Lingual membrane quite peculiar, marginals quadrate.

For figure of animal, jaw, and lingual dentition, see Terr. Moll. U. S., V.

Asia, Africa, South and North America, in warm latitudes.

Binneya, J. G. COOP. (*Xanthonyx*, Cr. & Fisch.) Animal sublimaciform, blunt before, tapering behind: tentacles simple: mantle subcentral, covered by a shell, with an anterior expansion: no longitudinal furrows above the margin of the foot, and no caudal mucus pore: a distinct locomotive disk: external respiratory and anal orifices on the right posterior margin of the mantle, under the peristome of the shell: orifice of combined genital system behind and below the right eye-peduncle.

Shell external, paucispiral, auriform, not enclosing the animal.

Jaw ribbed.

Lingual membrane with tricuspid central teeth, bicuspid laterals, and quadrate marginals.

Mexico and islands off southern coast of California.

The animal has the peculiarity during estivation of forming a testaceous covering extending from the peristome over the parts not protected by the shell.

The body is not attached its whole length to the foot, the viscera forming a turbinate spiral mass, partially protected by the shell.

Hemphillia, BL. & BINN. Animal limaciform, blunt before, swollen at centre, and greatly attenuated behind : tentacles simple : mantle subcentral, large, oval, concealing all but a rounded large orifice, an internal shell-plate : longitudinal furrows above the margin of the foot and caudal mucus pore, over which is a hump-like process : no distinct locomotive disk : external respiratory and anal orifices at the central right margin of the mantle : orifice of combined genital system near the right eye-peduncle.

Shell-plate horny, small, unguiform, longer than wide, with posterior nucleus and concentric lines of growth.

Jaw ribbed.

Lingual membrane with tricuspid central teeth, bicuspid laterals, and quadrate marginals.

Coast of Oregon.

The swollen central portion of the animal seems the first approach to a turbinate mass of viscera, separated from the foot.

Geomalacus, ALM. Animal limaciform, subcylindrical, blunt behind : tentacles simple : mantle anterior, close to head, concealing a shell-plate : longitudinal furrows above the margin of the foot? a caudal mucus pore : a distinct locomotive disk : external respiratory and anal orifices on the right far anterior margin of mantle : orifice of combined genital system behind and below right eye-peduncle.

Shell-plate calcareous, flat, small, internal, ovate.

Jaw ribbed.

Lingual membrane with tricuspid centrals, bicuspid laterals, quadrate marginals.

Eastern Europe.

For figure of the animal and internal shell plate, see Adams's Genera ; of jaw and lingual dentition, see Heynemann, Malak, Blatt., XXI., Nachr. der Malak, Gesell., T. 165, Pl. I.

Letourneuxia, BOURG. Animal limaciform, subcylindrical, scarcely attenuated behind : tentacles simple : mantle small, anterior, concealing a shell-plate : no longitudinal furrows above the margin of the foot, and no caudal mucus pore ; no distinct locomotive disk : external respiratory and anal orifices on the right anterior margin of the mantle : orifice of combined genital system ?

Shell-plate internal, calcareous, suboval, flat.

Jaw ribbed.

Lingual membrane ?

Algiers.

There is a peculiar overhanging process to the side of the body, near the tail.

For figure of animal, internal shell-plate, and jaw, see Bourignat, Moll. Nouv., VII., 1866, p. 201, Pl. XXXIV. Fig. 7.

Peltella, WEBB & VAN BEN. (*Pectella*, Gray.) Animal limaciform, rounded above, flat below, sides widely expanded : tentacles simple : mantle

small, oval, posterior, concealing a shell : no longitudinal furrows above the margin of the foot, and no caudal mucus pore : distinct locomotive disk ? external respiratory and anal orifices on the right anterior margin of the mantle ; orifice of combined genital organs behind and below right eye-peduncle.

Shell internal, sigaretiform, rudimentary, small, flat, oblong, subspiral, nucleus infero-posterior.

Jaw ribbed.

Lingual membrane — ?

Brazil.

Until the jaw and dentition be known, its position is uncertain. The former from one of Férussac's figures seems to be costate.

For figure of animal, see Férussac, Hist., Pl. VII. A.

From Férussac's figure 4 it appears probable that the shell may be more properly described as external, but covered by an accessory process of the mantle.

Cryptostrakon, W. G. BINN. Animal limaciform, subcylindrical, attenuated behind : tentacles simple : mantle slightly anterior, thin, small, concealing the shell : no longitudinal furrows above the margin of the foot, and no caudal mucus pore : distinct locomotive disk ? external respiratory and anal orifices on the right central margin of the mantle : orifice of genital organs ?

Shell internal, sigaretiform, rudimentary, large as mantle, membranous, subspiral, with postero-lateral nucleus.

Jaw ribbed.

Lingual membrane with tricuspid central teeth, bicuspid laterals, and quadrate marginals.

Costa Rica.

For figure of animal, internal shell, jaw, and lingual dentition, see Ann. of N. Y. Acad. Nat. Sci., I., Pl. XI.

Gæotis, SHUTTL. Animal limaciform, with greatly expanding, flat sides : tentacles simple : mantle with an appendiculate process on the right posterior margin under the spire of the shell, which is internal, concealed before by a reflection of the mantle, and behind is imbedded in the mantle : longitudinal furrows — ? caudal pore — ? distinct locomotive disk ? external respiratory and anal orifices at the right posterior margin of the mantle : orifice of generative organs — ?

Shell internal, rudimentary, thin, subspiral, sigaretiform.

Jaw with numerous delicate ribs, as in *Cylindrella*.

Lingual membrane with peculiar, long, narrow teeth, centrals bluntly tricuspid, laterals and marginals bluntly tricuspid.

Porto Rico.

For figure of the shell, see Genera of Recent Mollusca, Pl. LXXII. Fig. 6 a ; for jaw and lingual membrane, see Ann. Lyc. Nat. Hist. of N. Y., X., Pl. XI. ; for description of animal, see Shuttleworth, Bern Mit., 1854, p. 34.

The appendiculate mantle and position of the respiratory and anal orifice distinguish it from *Peltella*, and the jaw seems different.

ELASMOGNATHA.

Omalonyx, D'ORB. (*Pelta*, Beck.) Animal limaciform, blunt before, short behind : tentacles simple : mantle large, central, its margins holding the edges of the external shell : no longitudinal furrows above the margin of the foot, and no caudal mucus pore : no distinct locomotive disk : external respiratory and anal orifices on the right central margin of the mantle : generative orifice below and behind the right eye-peduncle.

Shell external, its margins imbedded in the mantle, rudimentary, non-spiral, oval, depressed, unguiform.

Jaw smooth, with median projection and accessory quadrate plate.

Lingual membrane with tricuspid centrals, tricuspid laterals, and multifid quadrate marginals.

West Indies and Brazil.

For figure of animal and shell, see Genera of Recent Mollusca ; for jaw and lingual dentition, see Heynemann, Malak, Blatt., 1868.

Hyalimax, H. & A. AD. Animal limaciform, swollen at centre, blunt before, and tapering behind : tentacles simple : mantle large, central, concealing all but a small opening, an internal shell-plate : no longitudinal furrows above the margin of the foot, and no caudal mucus pore : no distinct locomotive disk : external respiratory and anal orifices on the central right margin of the mantle : orifice of combined genital system on right side of head, half-way between eye-peduncle and mantle.

Shell large, rudimentary, thin, oval, unguiform, non-spiral.

Jaw smooth, with blunt median projection and accessory quadrate plate.

Lingual membrane with tricuspid central teeth, multifid laterals, and quadrate marginals.

Mauritius.

For figure of animal, shell, jaw, and lingual dentition, see Fischer, Journ. de Conch., XV. 218, Pl. X.

Specimens from Mauritius examined by myself have the opening in the mantle, which was not noticed by Fischer.

Athoracophorus, GOULD. (*Janella*, Gray ; *Aneitea*, Gray ; *Aneiteum*, McDon. ; *Tribiniophorus*, Humbert.) Animal limaciform, subcylindrical, tapering behind : tentacles wanting : mantle anterior, small, triangular, lateral, adherent, enclosing one or more shell grains or plates : no longitudinal furrows above the margin of the foot, and no caudal mucus pore ; no distinct locomotive disk : external respiratory and anal orifices on the right central margin of the mantle : orifice of combined genital system behind and below the right eye-peduncle.

Shell-plate internal, flat, calcareous, oblong, sometimes in separate grains.

Jaw smooth, with median projection and quadrate accessory plate.

Lingual membrane with peculiarly shaped teeth, with long, narrow, curving base of attachment, and low, transverse, multifid cusp.

New Hebrides, etc.

For figure of animal, shell-plate, jaw, and lingual dentition, see Fischer, Journ. de Conch., 1868, XVI. 230, Pl. XI.

The animal has peculiar dorsal grooves.

DOUBTFUL GENERA.

Parmella, H. & A. ADAMS. (Proc. Zoöl. Soc., 1867, 308, Pl. XIX. Fig. 20.) Fejee Islands. No information whatever given of the animal. Shell sigaretiform, as in *Gæotis*, *Peltella*, and *Mariella*.

Othelosoma, GRAY. (Ann. Mag. Nat. Hist., New Series, III. 241.) Gaboon. No exact description given.

Damayantia, ISSEL. (Ann. Mus. Genov., VI., 1874, Pl. IV. Fig. 4-6 and woodcut.) No shell; mantle anterior; caudal pore. Borneo. I have not seen this description.

Aspidiporus, FITZ. (1833, Verz., 90.) Vienna. Like *Limax*, with perforated mantle.

Laconia, GRAY. (Brit. Mus. Cat., 63.) Sublimaciform. Founded on Férussac's Fig. 10, 11, of Pl. VIII. F. Shell of *Vitrina*, with large caudal pore. Shell concealed by mantle: rather heliciform.

Oris, RISSO. Syn. of *Onchidium*?

Limacellus, BLAINV. See Fér. Hist., p. 52, Pl. VII. Fig. 1, for full description and figure.

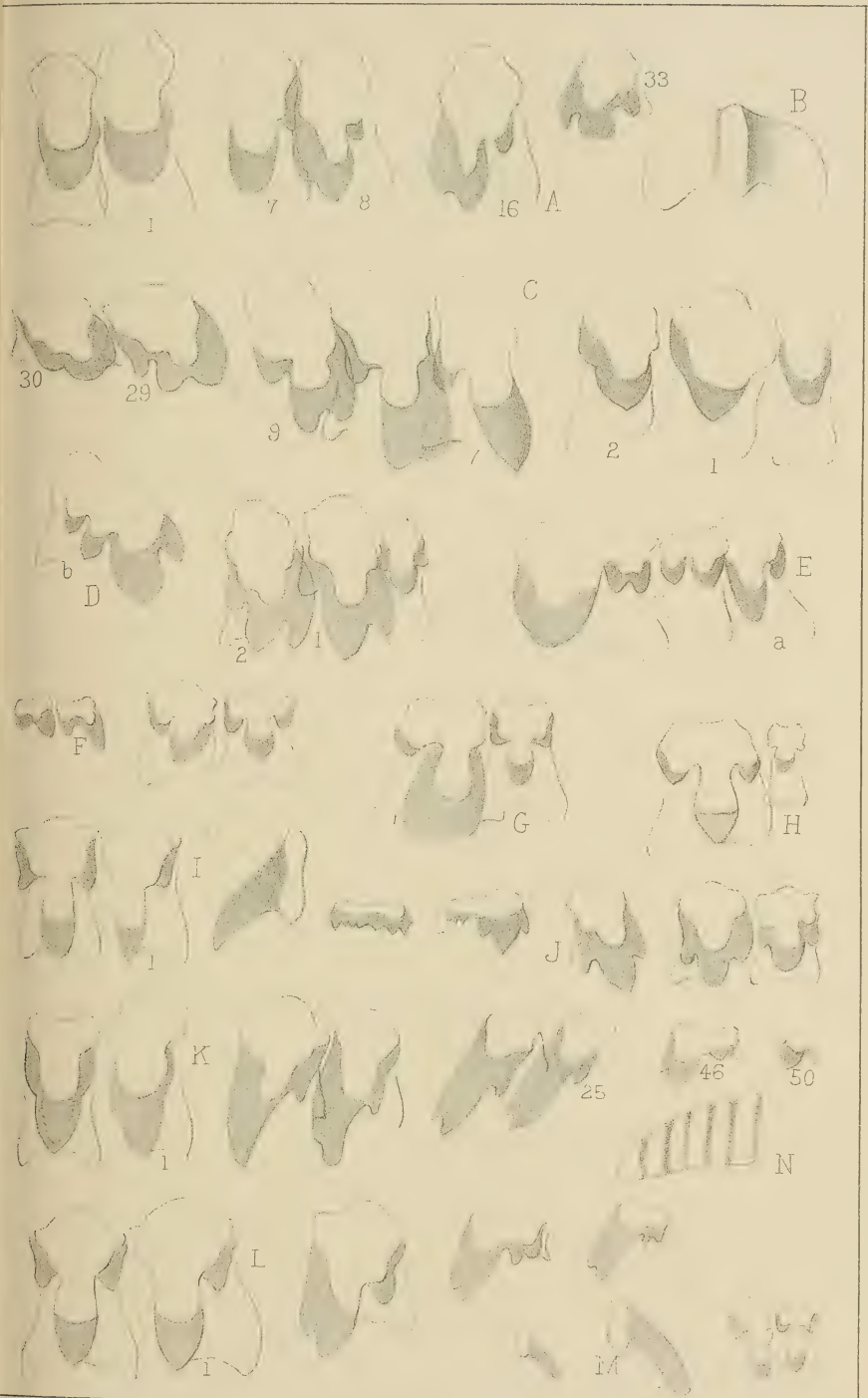
Parmula and **Scutelligera** are larvæ of insects. See Gray, Br. Mus. Cat., 161.

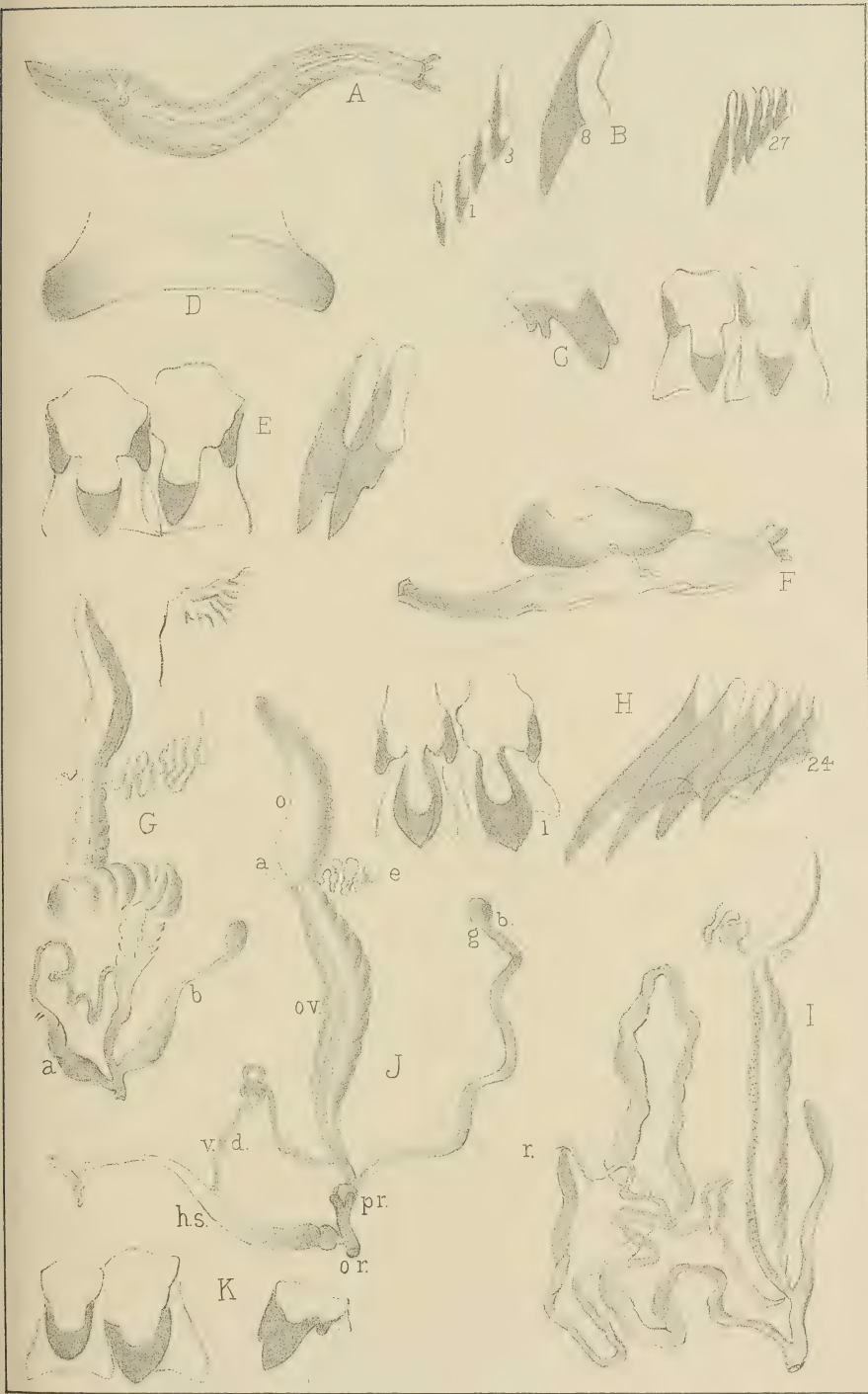
Eumelus, **Deroceras**, **Zilotea**, **Urcinella**, **Testacina**, **Limacias**, RAFINESQUE. (See Terr. Moll., V., and Binney and Tryon's edition of Rafinesque.)

Plectrophorus, BOSC. See Férussac, Hist., p. 84, Pl. VI. Fig. 5-7.

Phosphorax, WEBB & BERTH. Animal limaciform, swollen at middle: tentacles simple: mantle large, anterior, with a posterior, small, phosphorescent disk, and concealing a shell-plate: no longitudinal furrows above the margin of the foot, and no caudal mucus pore shown in plate: distinct locomotive disk? external anal and respiratory orifices on right anterior margin of mantle: generative orifice? Internal shell-plate thick, oval, testaceous. Jaw? Lingual membrane? Teneriffe. For figure of animal, see Férussac, Hist., Pl. II. Fig. 8. A doubtful genus, so little do we know of it. It is impossible to ascertain its systematic position.

A new genus of elasmognathous slug is indicated, but not named, in Zoöl. Rec., 1877, p. 74, founded on *Parmarion Kersteni*.





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A SUPPLEMENT TO THE FIFTH VOLUME OF THE TERRESTRIAL
AIR-BREATHING MOLLUSKS OF THE UNITED STATES AND
ADJACENT TERRITORIES.

BY W. G. BINNEY.

CAMBRIDGE:
PRINTED FOR THE MUSEUM.
DECEMBER, 1883.

No. 8. — *A Supplement to the Fifth Volume of the Terrestrial Air-Breathing Mollusks of the United States and Adjacent Territories.*
By W. G. BINNEY.

THE following pages embody all the additional information relating to the subject which I have been able to obtain since the publication in the Bulletin of the Museum of Comparative Zoölogy, Vol. IV., of the fifth volume of the Terrestrial Air-Breathing Mollusks of the United States.

BURLINGTON, NEW JERSEY, July, 1883.

In the chapter on Geographical Distribution several additions and corrections are to be made.

On p. 18 to the first list add : —

Onchidium Carpenteri.

The species are said to range over the *whole* of the Pacific Province. Some of them are only coast range species in California, not being found in the Sierra Nevada.

On p. 19 to the second list add : —

Macrocyclus Hemphilli.

Onchidium borealis.

In the Californian Region (p. 19), the range of the species is limited, as shown in the descriptive portion of the work. Most of the species are confined to the vicinity of the coast ; as, —

Macrocyclus Voyana.

Arionta Nickliniana.

Duranti.

Californiensis.

Limax Hewstoni.

Traski.

Ariolimax niger.

Carpenteri.

Hemphilli.

sequoicola.

Andersoni.

Dupetithouarsi.

Aglaia infumata.

Diabloensis.

Arionta arrosa.

Stearnsiana.

exarata.

Euparypha Tryoni.

Glyptostoma Newberryanum.
Pupa Rowelli.
Californica.

Onchidium Carpenteri.
Veronicella olivacea.

Still as coast species, but confined to islands, are:—

Arionta intercosa.
Ayersiana.
Kelletti.

Arionta ruficincta.
Gabbi.
Binneya notabilis.

In the Sierra Nevada are found:—

Vitrina Pfeifferi.
Zonites Whitneyi.
chersinellus.
Gonostoma Yatesi.

Polygyra Harfordiana.
Aglaia Hillebrandi.
Arionta Mormonum.

Both in the coast counties and Sierra Nevada are found:—

Ariolimax Californicus.
Triodopsis loricata.

Arionta tudiculata.

The last species near the coast only between San Buenaventura and San Diego.

Pupa corpulenta is incorrectly referred in the lists to the Pacific rather than Central Province.

On p. 21, in the first list add:—

Macrocyclus Hemphilli.

In the second:—

Onchidium Carpenteri.

To the list on p. 22 add:—

Onchidium Carpenteri.
borealis.

Macrocyclus Hemphilli.

And omit *Pupa corpulenta*, a species restricted to the Central Province. This last species is to be added to the list on p. 24.

To the list on p. 33 add:—

Zonites petrophilus.
Wheatleyi.
Rugeli.
Lawi.
cuspidatus.

Zonites macilentus.
Andrewsi.
Patula Bryanti.
Helicodiscus fimbriatus.
Mesodon Andrewsi.

To the list on p. 37 add:—

Triodopsis Levettei.

Triodopsis Copei.

Glandina truncata, GMELIN. (p. 84.)

Found also in North Carolina.

Glandina Texasiana, PFEIFFER. (p. 87.)

Found also in Louisiana.

Macrocyllis Voyana, NEWCOMB. (p. 93.)

A smaller variety of 9 mm. greater diameter is found at Los Angeles.

Macrocyllis Hemphilli, W. G. BINN.**Plate II. Fig. M.**

At Olympia, Oregon, Mr. H. Hemphill collected several specimens of a *Macrocyllis*, which appears to be distinct from, though nearly allied to, *M. Vancouverensis*. It may be best described by saying that

The umbilicus is narrower and not excavated so much, the termination of the last whorl not receding from the umbilicus as in all the forms of *Vancouverensis* and *concava*; in all, the whorls are more or less strongly striated within the umbilicus, often almost ribbed in *concava*; not so in this shell; the texture of the shell is glassy like *Hyalina*, and there is no trace of the microscopic spiral lines found in all the other forms; beneath, the last whorl is proportionately wider. The greater diameter is 14 mm.; lesser, 10; height, 5.

The jaw and lingual dentition are as usual in the genus. I could not distinguish the characters of the central tooth in this species.

Zonites capnodes, W. G. BINN. (p. 98).**Plate III. Fig. C.**

Living specimens received from near Knoxville, Tenn., through the kindness of Mrs. George Andrews, have enabled me to figure the genitalia. The genital bladder (*g. b.*) is large, globular, on a short, narrow duct: the penis-sac (*p. s.*) has the same peculiar accessory process which I have detected in those of *Z. lævigatus*, *Rugeli*, *fuliginosus*, *friabilis*, and *inornatus*. There is a vaginal prepuce.

It is in many individuals more easy to distinguish *capnodes* from *fuliginosus* by the dentition than by the shell.

Zonites fuliginosus, GRIFF. (p. 100.)

In a specimen from Indiana, sent me by Mr. F. Stein, I find the same accessory process to the penis-sac noticed above. It is not given in Leidy's figure in Vol. I.

Zonites Rugeli W. G. BINN.

Plate II. Figs. H, I. Plate III. Fig. D.

Shell depressed globose, perforated, thin, delicately wrinkled, the apical whorls sometimes striate, greenish horn-colored, dark smoky above; spire slightly elevated, apex flat; whorls 6, slightly rounded, the last globose, scarcely excavated at the perforation; aperture large, rounded, oblique; peristome simple, thin; ends slightly approaching; the columellar one scarcely broadened. Diameter, larger, 19 mm.; lesser, 15 mm.; height, 9 mm.

Zonites Rugeli, W. G. BINN., Ann. N. Y. Acad. Sci., Vol. I. No. 2, p. 357, Pl. XV. Fig. H, Pl. XIV. Fig. D, 1879.

Roan Mountain, Mitchell Co., North Carolina. Mrs. George Andrews.

When first received, I believed this to be an extremely globose form of *Z. inornatus*, but an examination of the lingual dentition showed this to be impossible.

I have given a figure of the genitalia. It will be seen that the accessory part of the penis-sac is in this species continued to a point beyond the retractor-muscle: otherwise the genitalia are very similar to these of *capnodes*, *friabilis*, *inornatus*, *laevigatus*, and *fuliginosus*.

Jaw as usual in the genus. Lingual membrane as usual: teeth 38-1-38. There are about 4 or 5 laterals; the 8th is a pure marginal on either side of the central line. It will be seen that *inornatus*, *subplanus*, and *laevigatus* are peculiar in having no perfect lateral teeth, but only transition teeth: *fuliginosus*, *capnodes*, and *friabilis*, as well as *Rugeli*, have well-formed laterals, differing in number in the various species: thus the lingual dentition in this group is a good guide in distinguishing the species.

The animal is dark slate-colored: the caudal mucus-pore is a longitudinal slit, as in *suppressus*.

Some individuals have their apical whorls striate, as in *Z. subplanus*.

Zonites laevigatus, PFEIFFER. (p. 102.)

The caudal mucus-pore seems to be round, and not a simple longitudinal slit as in *Z. capnodes*, *friabilis*, *fuliginosus*, *Rugeli*, and *inornatus*.

The globose variety shares with the type the peculiar lingual dentition.

Zonites demissus, BINNEY. (p. 104.)

Found also at Cedar Keys, Florida, and Texasana, Texas.

From the mountains of North Carolina and Tennessee I have received a gradual series of size from the typical *demissus* to *acerrus*.

Zonites intertextus, BINNEY. (p. 106.)

I have received it from Texas.

Zonites subplanus, BINNEY. (p. 107.)**Plate II. Fig. J.**

This rare species has lately been found on Roan Mountain, Mitchell Co., North Carolina, by Mrs. George Andrews.

The dentition (see plate) is the same as in *Z. inornatus*.

The shell from Roan Mountain is very dark, almost black. Wyoming Co., Pennsylvania (J. S. Phillips).

Zonites sculptilis, BLAND. (p. 109.)

Found also at the mouth of Laurel River, Wilby Co., Kentucky (A. G. Wetherby).

Zonites cerinoideus, ANTHONY. (p. 111.)

Zonites cuspidatus, Lewis, is a variety of *Z. gularis*, or a distinct species. See below, p. 143.

Zonites cellarius, MÜLLER. (p. 111.)

St. Louis (L. B. Case).

Zonites Whitneyi, NEWCOMB. (pp. 113, 432.)**Plate III. Fig. L.**

The dentition is figured on the plate referred to.

Zonites viridulus, MENKE. (p. 115.)

Portland, Oregon (H. Hemphill).

Zonites indentatus, SAY. (p. 116.)

To the synonymy add :—

Hyalina subrupicola, DALL, Bull. U. S. Geol. and Geogr. Survey of the Territories, Vol. III. No. 1, p. 163, Fig., April, 1877.

A copy of Dr. Dall's description and figure are here given (the latter on Pl. IV. Figs. H, I) :—

Of the following species, described by Mr. W. H. Dall, several examples

occurred. Specimens were sent to Mr. W. G. Binney, who regards it as "apparently an albino variety of *Zonites indentata*." Specimens were submitted to Prof. J. S. Morse, who judged it to be quite distinct from *Z. indentata*. Other specimens were sent to Mr. Dall, who describes it as a new species, and has kindly prepared the following notice.

HYALINA SUBRUPICOLA, n. sp. (Fig. 7).

This little shell is best described by a comparison of its various characteristics with those of *H. indentata*, Say, as given by Mr. Binney in his *Land and Fresh-water Shells of the United States* (Part I. p. 35).

H. subrupicola, while exhibiting radiating lines of growth, some of which are more conspicuous than others, does not show any such well-marked grooves or indentations as are figured by Morse (*Land Shells of Maine*) in *indentata*, and which form its most striking character. The former has five and a half whorls, with a greatest diameter in the largest specimen of 0.14 inch, while *indentata* has but little more than four, with a diameter of 0.20 inch. The former is perfectly pellucid, while the latter has a peculiar whitish spermaceti-like lustre. *H. subrupicola* has the last whorl smaller proportionally than *indentata*, and in fact the increment of the whorls in the former is much more regular and even. The umbilicus in both is precisely similar.

The animal of *subrupicola* varies from whitish to slaty; the granules of the upper surface of the foot are remarkably coarse and well marked. The tentacles are, as contracted in alcohol, hardly perceptible; the eye-peduncles are from the same cause not extended, but appear to be as usual in the genus, and to possess normal ocular bulbs. The office filled by these, however, being quite as much of a tactile nature as for purposes of sight, the usual rule in regard to the blindness of most cave animals does not apply in the case of the *Helicidae*. With the exception of *H. indentata*, this species does not seem very near to any of the described American species, and it is totally dissimilar to *Ammonitella Yatesii*, J. G. Cooper, a remarkable form found in caves in Calaveras County, California.

Hab. — Cave in Utah. Collected by Dr. A. S. Packard, Jr., of Dr. Hayden's Survey.

It may be noted that *H. indentata* does not appear to have been collected west of the Rocky Mountains.

***Zonites petrophilus*, BLAND.**

Plate I. Fig. F.

T. late umbilicata, depresso-subglobosa, tenuis, nitens, translucens, albida, irregulariter striata; sutura mediocris; anfr. $5\frac{1}{2}$ -6, convexiusculi, ultimus convexior, non descendens; umbilicus extus late excavatus, perspectivus; apertura rotundato-lunaris; peristoma simplex, paululo subincrassatum, saepe roseum, margine columellari reflexiusculo.

Shell broadly umbilicate, depressed; subglobose, thin, shining, translucent, whitish, irregularly striated; suture moderately impressed; whorls $5\frac{1}{2}$ –6, rather convex, the last more convex, not descending; umbilicus widely excavated externally, pervious; aperture roundly lunate; peristome simple, somewhat thickened, often rose-colored, the columellar margin slightly reflected. Diameter, greater, 6mm.; lesser, $5-5\frac{1}{4}$ mm.; height, hardly 3 mm.

Zonites petrophilus, BLAND, Ann. N. Y. Acad. Sci., Vol. II., Fig., p. 369 (1883).

The Cliffs, Knoxville, Tennessee, found with *Z. Wheatleyi*, Mrs. George Andrews.

This species is, in general form, nearly allied to *Z. arboreus*, but the color is different, the striæ are more developed, and the umbilicus is much wider.

My friend, Mr. W. G. Binney, examined the dentition of *Z. petrophilus*, and favored me with notes on the subject. He found the teeth 15–1–15, with two perfect laterals, one only on each side. *Z. viridulus* has the same number of laterals, but many more marginals.

I would express my deep obligation to Mrs. Andrews for her uniform kindness and liberality in supplying me, during many years, with numerous rare and interesting species. (Bland.)

Fac-similes of the original figures are given on Pl. I. Fig. F.

Zonites Wheatleyi, BLAND.

Plate I. Fig. G.

T. umbilicata, depressa, tenuis, nitens, pellucida, fusculo-cornea, delicata striatula; spira subplanulata; sutura leviter impressa; anfr. $4\frac{1}{2}$, convexiusculi, ultimus basi convexior, ad aperturam rapide accrescens, vix descendens; umbilicus pervius; apertura depressa, oblique lunaris; peristoma simplex, acutum, marginibus approximatis, callo tenui junctis.

Shell umbilicated, depressed, thin, shining, pellucid, brownish horn-colored, finely striated; spire subplanulate; suture slightly impressed; whorls little convex, the last more convex at the base, rapidly increasing at the aperture, scarcely descending; umbilicus pervious; aperture depressed, obliquely lunate; peristome simple, acute, the margins approximating, joined by a thin callus.

Greater diameter, 5 mm.; lesser, $3\frac{1}{2}$ mm.; height, 2 mm.

Zonites Wheatleyi, BLAND, Ann. N. Y. Acad. Sci., Vol. II. p. 368, Fig. 1 (1883).

The Cliffs, Knoxville, Tennessee, Mrs. George Andrews; also, Tiverton, Rhode Island, J. H. Thomson.

This, with the following species (*petrophilus*), was discovered and communicated to me, in 1879, by Mrs. Andrews, who thus described the locality in which the two species were found: "The Cliffs rise up 200 feet on the south side of the river; they are very steep and rocky, face the north, are almost

always shady, damp, and covered with mosses and ferns. I collected the shells on the ledges of the rocks among the dead leaves, at an elevation above the river of about 100 feet. I have not found either of the species in any other locality."

Mr. J. H. Thomson, to whom I submitted specimens, sent to me examples of the same species collected by him, "on a high rocky ledge, covered with old trees, at Tiverton, Rhode Island."

This species, *Z. Wheatleyi*, is more nearly allied to *Z. viridulus*, Menke, than to any other North American form, but differs from it, especially in the form of aperture, in the descending last whorl, and in having a wider umbilicus.

I dedicate the species to the memory of my late valued and lamented friend, Charles M. Wheatley. (Bland.)

Fac-similes of the original figures are given on Pl. I. Fig. G.

Zonites Binneyanus, MORSE. (p. 121.)

Vermont.

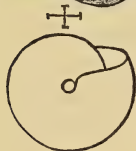
Zonites conspectus, BLAND. (p. 122.)

Alaska : Salem, Oregon : Merced Co., California (H. Hemphill.)



Zonites chersinellus, DALL. (p. 123.)

Dr. Dall gives the number of whorls $4\frac{1}{2}$ -5. A copy of his original figure is here given, as mine is said by him to be incorrect.



Zonites capsella, GOULD. (p. 123.)

Lexington, West Virginia ; Knoxville, Tennessee (Mrs. George Andrews).

The true *capsella* has 15-1-15 teeth on the lingual membrane, two on each side of the median tooth being true laterals ; the fourth is a marginal.

Zonites placentula, SHUTTLE. (p. 124.)

Plate II. Fig. A.

The description in Vol. V. is a translation of that of Shuttleworth. Fig. 44 in Vol. V. represents *Zonites Lawi* (see below). The true *placentula* is here figured.

Zonites Lawi.

Plate II. Fig. E.

I propose to indicate under the name of *Z. Lawi* the form here figured and formerly considered by me as *Z. placentula*. When the limits of the species in

this puzzling group are better understood, a description of *Z. Lawi* may be given.

Zonites placentula, W. G. BINN. (not of Shuttleworth), Terr. Moll. U. S., V. 124, Fig. 44, not description.

Mountains of Tennessee and North Carolina.

There is a variety in which is a heavy internal callus or plate like teeth within the aperture.

This species furnished the lingual membrane described in Vol. V. as that of *Z. capsella*.

***Zonites fulvus*, MÜLL. (p. 125.)**

The dentate form sometimes has radiating rows of teeth, as in *multidentatus*.

***Zonites Stearnsi*, BLAND. (p. 130.)**

This species from the ribbed form of its jaw must be considered a *Microphysa* (see below).

***Zonites cuspidatus*, LEWIS. (p. 113.)**

Plate II. Fig. C.

This form, previously referred by me to a variety of *Z. cerinoideus*, may be considered a distinct species, or a form of *gularis*. It is not a variety of *cerinoideus* (see p. 111). The internal tooth-like processes within the aperture strongly curved one towards the other form almost an arched space. The umbilicus is closed.

Found by Miss Law in Monroe Co., Tennessee; by Mrs. Andrews on Roan Mountain, Mitchell Co., North Carolina.

***Zonites macilentus*, SHUTTL.**

Plate II. Fig. B.

Formerly I referred this to *Z. lasmodon*, but having received specimens from near Shuttleworth's original locality, I am convinced of its being distinct. The original description is given in Vol. III. p. 20.

It is found in the mountains of Tennessee and North Carolina.

***Zonites lasmodon*, PHILLIPS. (p. 131.)**

The caudal mucus pore is erect, not the simple longitudinal slit as in *Z. suppressus* (see Fig. on p. 128).

Zonites significans, BLAND. (p. 132.)**Plate II. Fig. G.**

By an unfortunate mistake another shell is figured on p. 132. That now given correctly represents the species.

Roan Mountain, Mitchell Co., North Carolina (Mrs. G. Andrews).

To synonymy add:—

Hyalina significans, HARPER, Journ. Cin. Soc. N. H., Oct., 1881, p. 258, Figs. 2, 2 a.

Zonites multidentatus, BINSEY. (p. 133.)**Plate II. Fig. F.**

For comparison with the last-mentioned and following species an enlarged figure is given.

Zonites Andrews, W. G. BINN**Plate II. Fig. D.**

The specimen figured was received from Mrs. G. Andrews, who collected it on Roan Mountain, Mitchell Co., North Carolina. It has the general appearance of *Z. significans*, *multidentatus*, and *lasmodon*, but differs so decidedly from each that I propose to designate it by the name of its discoverer. A full specific description can be given later. Compared with *Z. lasmodon*, it has fully 8 whorls, is $6\frac{1}{2}$ mm. in diameter, the umbilicus 1 mm. wide, whilst *lasmodon* with 7 whorls, is 7 mm. in diameter, with an umbilicus 2 mm. wide: the Roan Mountain shell has also five parallel lamellæ, while *lasmodon* has only two, or at most three, and does not show the successive rows of lamellæ which are characteristic of *Andrews*, radiating from the centre.

From *Z. significans* it differs in its larger size, greater number of whorls, much wider umbilicus, and in the character of its internal denticles, which are long and winding on the wall of the whorl; while in *significans* the denticles are simply erect and conical, with broad base. The same differences distinguish it from *multidentatus*, which is still smaller than *significans*, and has a much narrower umbilicus.

Zonites Andrews, W. G. BINN., Ann. N. Y. Acad. Sci., Vol. I. No. 2, p. 358, Pl. XV. Fig. D, 1879.

VITRINIZONITES, W. G. BINN.**Plate III. Fig. A.**

Animal heliciform, blunt before, in motion greatly acuminate behind: mantle subcentral, protected by an external shell: two longitudinal furrows

above the margin of the foot, meeting over a round caudal mucus-pore : distinct locomotive disk to foot : external orifice of combined generative organs on right side of body, far behind the eye-peduncles : of respiratory and excretory organs on the right of the mantle under the peristome : jaw smooth, with median projection : lingual membrane as in *Zonites*, central teeth tricuspid, lateral teeth bicuspid, marginals aculeate.

Shell external, *Vitrina*-like.

The above generic name is proposed for the shell described as *Vitrina latissima* (p. 136), as it combines the characters of *Vitrina* and *Zonites*. The animal differs from *Vitrina* by having simple, not bifid, marginal teeth to the lingual membrane, and by a caudal mucus-pore, with longitudinal furrows above the margin of the foot, and by the want of an appendiculate mantle. From *Zonites* it differs only in the form of the shell, though the caudal mucus-pore seems to be circular, with projecting process when open, rather than a simple longitudinal slit, as in *Zonites suppressus*. There appears no developed appendiculate mantle process.

The genus in my arrangement will follow *Zonites*.

Vitrinizonites latissimus, LEWIS. (p. 136.)

Plate I. Fig. H. Plate III. Fig. A, B.

I here add a figure of the animal in motion (Pl. III. Fig. A), not fully extended, drawn by Miss Emma Pringle. The caudal mucus-pore is circular, bordered with a narrow transversely grooved rim ; and when closed is covered completely. When open the cover is raised along its longitudinal centre into a sharp carina, leaving posteriorly, when seen from behind, an erect triangular opening. It thus differs from the simple longitudinal slit found in most of the American species of *Zonites*, such as *friabilis*, *capnodes*, *fuliginosus*, *inornatus*, *demissus*, *ligerus*, *suppressus*, the last figured in Vol. V., Fig. 47. *Z. lævigatus*, however, has a nearer approach to the circular pore of *Vitrinizonites*.

The genitalia are figured on Plate III. Fig. B. The ovary is very large (*ov.*) and stout : the genital bladder (*g. b.*) is globular on a short, narrow duct : the penis-sac (*p. s.*) is very long, narrow, cylindrical, receiving the retractor muscle (*r.*) near its basal termination, and merging at its apex into the vas deferens (*v. d.*). The penis-sac has not the accessory process found in *Zonites capnodes*, *friabilis*, *lævigatus*, *inornatus*, *fuliginosus*, and *Rugeli*.

The species has been found from Carter Co. to Blount Co., Tennessee, on the dividing line between Tennessee and North Carolina.

On Roan Mountain it is usually found under damp moss.

I am indebted to Miss Annie E. Law for the opportunity of examining the specimen figured. She collected it in June, 1879, at the original locality, Bald Mountain, Blount Co., Tennessee, on dividing line with North Carolina. At Washington Co., Tennessee, it was found by Dr. Rugel. Mrs. G. Andrews found it on Roan Mountain, in North Carolina (over 6,000 feet), on the divid-

ing line with Carter Co., Tennessee, and at Thunderhead of Smoky Mountains, North Carolina.

The lingual membrane is broad and not long; the ends are bluntly truncated. There are about 30 rows of 24-1-24 teeth each, arranged as in *Zonites*. There are six laterals, scarcely one perfect, mostly transition teeth, on each side of the central line; the seventh tooth is a marginal; the twelfth tooth is the largest. Plate I. Fig. H, shows all the teeth from the central to the first fully formed marginal, and the two extreme marginals. The dentition is nearest to that of *Zonites lævigatus*.

***Limax campestris*, BINNEY. (p. 149.)**

An exhaustive paper by E. L. Mark on the Maturation, Fecundation, and Segmentation of this species will be found in Bull. Mus. Comp. Zoöl., Vol. VI. No. 12.

***Limax Hewstoni*, J. G. COOPER. (p. 150.)**

Found by H. Hemphill, from Portland, Oregon, to San Tomas River, Lower California.

***Patula solitaria*, SAY. (p. 156.)**

I have seen one specimen from Madison, Indiana, measuring 35 mm. greater diameter.

***Patula strigosa*, GOULD. (p. 157.)**

To synonymy add:—

Helix Bruneri, C. F. ANCEY, Le Naturaliste, III. p. 468, Sept. 1st, 1881. (*Anguispira*.)

Diam. maj. $15\frac{1}{2}$ mm.; min. 14 mm.; alt. 7 mm.—Testa sordide alba, pervie lateque umbilicata, utrinque convexa, valde depressa. Spira obtusissima, latissime subconica; anfr. 5, valde convexis; grosse striis incrementi parum regularibus, costisque spiralibus crenulatis, interdum subinterruptis, supra, in anfractibus primis præsertim, vix distinctis sculpta. Sutura marginata, impressa, subplanulata. Anfr. ult., ad peripheriam carina exserta, non acuta, munitus, costis spiralibus circa 8 subtus intructus. Apertura submarginato-circularis, obliqua; peristomium simplex, acutum, marginibus callo tenui junctis. Testa colore sordide albo, vittis duabus brunneis ad peripheriam aliquando munita.

Montana (L. Bruner).

Cette espèce, du groupe de *L'Helix (Anguispira) Cooperi*, W. G. Binney, m'en semble réellement distincte par la carène très sensible, mais nullement aiguë de son dernier tour, les côtes spirales dont elle est pourvue surtout en dessous, par sa forme beaucoup plus déprimée, également convexe en dessus et

en dessous. L'ombilic parait en proportion plus large. *L'Helix Haydeni* Gabb, en diffère par ses côtes spirales mieux marquées, très apparentes des deux côtes, sa carène plus aiguë, et son ombilic moindre. *L'H. Bruneri* présente avec *L'H. Hemphilli*, à peu près les mêmes différences qu'avec *L'H. Cooperi*. Sauf les côtes spirales, cette coquille présente les plus grands rapports de forme avec *L'H. (Xerophila) filimargo*, de la Crimée. L'ombilic et la carène sont aussi presque identiques. (Ancey.)

***Patula perspectiva*, SAY. (p. 164.)**

A carinated form is found in Union Co., Tennessee.

***Patula Bryanti*, HARPER. (p. 165.)**

Plate I. Fig. C.

Shell broadly and perspectively umbilicate, discoidal, nearly flat above, and deeply excavated below; whorls 5, gradually increasing, regularly ribbed, outer whorl bicarinate; color light-brown; aperture small, rhomboidal; peristome simple, acute, having its extremities united. Greater width, $6\frac{1}{2}$ mm.; least, $5\frac{1}{2}$ mm.; height, 2 mm.; width of umbilicus, $4\frac{1}{2}$ mm. (Harper.)

Patula Bryanti, HARPER, Journ. of Cincinnati Soc. Nat. Hist., Oct., 1881, p. 258, Figs. 1, 1 a.

Found deeply buried under old logs on Roan Mountain, Mitchell Co., North Carolina.

I have given the original description above, and figures of one of the original specimens kindly furnished by Prof. Harper.

It may prove a carinated variety of *perspectiva*, but apparently deserves to be designated by a specific name.

***Patula striatella*, ANTHONY. (p. 165.)**

Said to be found in Kamtschatka and Northern China, distinct from *pauper*, by Möllendorff. J. B. Moll. Ges., VIII. 35.

***Patula asteriscus*, MORSE. (p. 167.)**

Tacoma, Washington Territory.

***Microphysa Stearnsi*, BLAND.**

Plate II. Figs. N, O.

Olympia, Washington Territory, and Portland, Oregon. (H. Hemphill.)

As shown above, from an examination of the jaw and lingual dentition, it

appears that this species is not a *Zonites*, as originally described, but rather a *Microphysa*, like *M. Lansingi* and *M. Ingersolli*. With the former it shares the peculiarity of having a ribbed jaw and aculeate marginal teeth to its lingual membrane.

The jaw has over 19 ribs of the same type as those of *M. Lansingi* (see Pl. II. Fig. O). A portion only of the jaw is figured.

The lingual membrane (Pl. II. Fig. N) has four laterals on each side of the central tooth.

***Microphysa Ingersolli*, BLAND. (p. 173.)**

Ogden, Utah.

***Onchidella Carpenteri*, W. G. BINNEY. (p. 179.)**

Body oblong, extremities bluntly rounded: upper surface regularly arched; below, quite near the edge, the border of the mantle is readily distinguished; most of the under surface is occupied by the broad, distinct locomotive disk: the body is uniformly smoke-colored; the four specimens received vary from 5 to 3 mm. in length.



Onchidium Carpenteri, W. G. Binn., Proc. Phila. Ac. N. Sc., 1860, p. 154. Land & Fresh-W. Sh. N. A., Part I. p. 308, Fig. 545 (1869).

Unfortunately omitted from Vol. V. The locality, Cape San Lucas, is doubtful. It is so referred, probably by mistake, in the volume of Land and Fresh-water Shells of North America, quoted above. There is no jaw, which renders still more peculiar the presence of one in *O. borealis*; on this account, I place the genus in *Agnatha* in the catalogue offered with this. The dentition is as in *O. borealis* (see Vol. V.). The upper margin of the base of attachment is still more prolonged in this species.

***Helicodiscus fimbriatus*, WETHERBY. (p. 186.)**

Plate I. Fig. D.

Shell light green color, discoidal or planiform, widely umbilicate, consisting of about five whorls, very gradually increasing in size. Aperture lunate, and oblique to the axis of the shell. Peristome subacute, slightly thickened, and darker than the rest of the shell, the outline somewhat sinuous when viewed from the side of the whorl. Suture deeply and regularly impressed. Umbilicus exhibiting all the volutions. Whorls ornamented with from 6 to 8 revolving ridges, terminating in a fringe-like projection of the epidermis, following this arrangement. Two or three of these ridges on the upper side of the body whorl are often of such prominence as to give that portion of the

shell a fluted appearance. In old shells these epidermal fringes are somewhat worn away, leaving the ridges upon which they stood. Greater diameter, 5 mm. ; lesser, $4\frac{1}{2}$ mm. ; height, $1\frac{1}{2}$ mm.

In some specimens as many as six teeth may be observed, none of which can be seen on the aperture. (Wetherby.)

Helicodiscus fimbriatus, WETHERBY, Journ. Cincinnati Soc. Nat. Hist., IV., Dec., 1881, p. 9.

Ocoee District, Eastern Tennessee.

The figure is drawn from one of Prof. Wetherby's specimens.

Ferussacia subcylindrica, LINN. (p. 187.)

To the synonymy add :—

Cionella (Zua) Morseana, DOHERTY, Quart. Journ. Conch., I. 342, Pl. IV. Fig. 2 (1878).

Pupa armifera, SAY. (p. 205.)

I am indebted to M. de St. Simon of Toulouse for a knowledge of the lingual dentition. There are 68 rows of 14–1–14 teeth, of which 7 on each side of the median line are laterals.

Pupa contracta, SAY. (p. 207.)

To the synonymy add :—

Pupa Cincinnatiensis, JUDGE, Quart. Journ. Conch., I. 343, Fig. (1878).

FOSSIL SPECIES OF PUPA. (p. 213.)

Add :—

Anthracopupa, WHITFIELD, Amer. Journ. Sc., [3,] 21, 126, cut.

Vertigo ovata, SAY. (p. 219.)

To the synonymy add :—

Zonites Upsoni, CALKINS, Valley Naturalist, St. Louis, Vol. II. No. 4, Dec., 1880, p. 53, Fig. Home and Science Gossip, Rockford, Illinois, March, 1881.

An examination of the lingual membrane alone would prove this to be a *Zonites*. Until then I retain it in *Vertigo*, as identical with or allied to *ovata*. I have, however, on Plate I. Fig. L, given a copy of one of the original figures, leaving out the striæ, which are exaggerated in the original, and here give the original description, from which the species may be recognized, should it prove a *Zonites*.

Shell conic, thin, transparent, shining, amber-colored, umbilicated; whorls $4\frac{1}{2}$, convex, very finely striated; striæ visible only under microscope. Suture distinct, aperture orbicular; peristome simple, acute, its outer termination perpendicular to the body whorl, the columellar termination reflected over the umbilicus. No internal teeth or process. Greater diameter, 1.35 mm.; lesser diameter, 1.20 mm.; length of axis, 1 mm. Locality, Winnebago Co., Illinois.

The animal not having been examined, I am unable to decide the generic character of the species with certainty; but judging from the shell I believe that it is a *Zonites*, and may be placed in the section *Conulus* of W. G. Binney's arrangement (Terr. Moll., Vol. V.). The shell resembles *A. harpa* in outline, but differs in other respects very materially. It is smaller; the texture of the shell is like that of *Conulus fulvus*. The striæ are visible only under the microscope. It is distinctly umbilicated, and the aperture is not oblique. It is no *Vertigo*. This shell, which is unlike any known *Helix*, was first discovered by Mr. Jesse B. Upson, in a damp meadow farm in Rockford, Illinois, beneath some refuse boards.

I have examined a large number of specimens under the microscope, and have made comparisons with many other species, both American and foreign, but have found none like it. There is no probability of its being an importation. The locality and surroundings forbid that.

I may mention that Messrs. Binney and Bland have examined the shell and agree that it is new. Such being the case, it is a matter of congratulation (though a surprise) to be able to add a new species to the American *Helices* from Illinois. I have the pleasure of naming the shell after the first discoverer, Mr. Upson. (Calkins.)

Mr. Upson suggests to me that the shell is the young of *V. ovata*, as it was found in company with mature specimens of that species.

Veronicella olivacea, STEARNS. (p. 243.)

"Lobitos is a small creek entering the sea about forty miles south of San Francisco Bay. The ranch and hamlet through which it passes bear the same name." (Stearns.)

Specimens of the original lot found in Nicaragua have kindly been furnished me by Dr. F. W. Putnam. The jaw has over 20 ribs. The lingual membrane is as usual in the genus.

HEMPHILLIA. (p. 246.)

Plate III. Fig. H.

Animal limaciform, blunt before, swollen at centre, and greatly attenuated behind: tentacles simple: mantle subcentral, large, oval, concealing all but a small portion of an internal shell-plate: longitudinal furrows above the

margin of the foot and caudal mucus-pore, over which is a hump-like process : no distinct locomotive disk : external respiratory and anal orifices at the central right margin of the mantle : orifice of combined genital system near the right eye-peduncle.

Shell-plate horny, small, unguiform, longer than wide, with posterior nucleus and concentric lines of growth, exposed in part.

Jaw ribbed.

Lingual membrane with tricuspid central teeth, bicuspid laterals, and quadrate marginals.

Coast of Oregon.

The swollen central portion of the animal seems the first approach to a turbinate mass of viscera, separated from the foot.

This emended generic description is drawn from larger specimens (40 mm. contracted in alcohol) collected at Portland, Oregon, by Mr. H. Hemphill. Found also at Tacoma, Puget Sound, and Olympia, Washington Territory, by the same collector.

***Polygyra auriculata*, SAY. (p. 263.)**

Cedar Keys : St. George's Island, Florida.

***Polygyra Texasiana*, MORICAND. (p. 270.)**

Fort Gibson, Indian Territory.

***Polygyra Dorfeuilliana*, LEA. (p. 278.)**

Fort Gibson, Cherokee Nation, Indian Territory : Alexandria, Louisiana.

Wetherby suggests the specific name of *Sampsoni* for the variety described in Vol. V.

***Polygyra pustuloides*, BLAND. (p. 287.)**

Lookout Mountain, Tennessee.

***Polygyra leporina*, GOULD. (p. 288.)**

Fort Gibson, Indian Territory.

***Polygyra Harfordiana*, J. G. COOPER. (p. 309.)**

Fig. 203 is said by Dr. Cooper not to represent his species, but rather the Salmon River small form of *Mesodon devia* var. *Mullani*. I have, therefore, here given a figure of Dr. Cooper's original type of *D. Harfordiana* preserved at the Academy of Natural Sciences at Philadelphia. The species from this seems more nearly allied to *Polygyra* than to *Triodopsis*.



It must be remembered that my figure of the dentition (Pl. VIII. Fig. R) and description of jaw were drawn from the Salmon River shell, not the typical shell found only in the Sierra Nevada region at "Big Trees."

Triodopsis vultuosa, GOULD. (p. 312.)

Plate III. Fig. J.

There are 12 ribs on the jaw. The lingual membrane has 20-1-20 teeth, 11 laterals on each side of the median line.

For the variety called *Henrietta*, see below.

Triodopsis Copei, WETHERBY.

Plate I. Fig. J.

Shell reddish, somewhat thin, deeply striated by lines of growth, and of medium size. Spire somewhat depressed in some specimens, slightly more elevated in others. Whorls 5, transversely striated with oblique lines of growth, and increasing very gradually and regularly in size; a faint carina appearing at the junction of the upper third and lower two-thirds of the body whorl, from which the latter tapers inwardly to the base of the shell. Sutures regularly and moderately impressed. Peristome subacute, and broadly reflected outward and downward at the lower two-thirds, and bearing on its basal third an acute carina, within which is seen a prominent, vertical, double tooth, of which the outer portion is the larger. A second tooth is carried by the inner margin of the peristome at the centre of the body whorl, the point of which is in close relation to an arcuate tooth carried by the parietal wall of the aperture. Umbilicus wide, exhibiting most of the volutions. Height, 7 mm.; greater diameter, 14 mm. This size is about the average. (Wetherby.)

Helix Copei, WETHERBY, Amer. Nat., Mar., 1877, p.

Twenty miles north of Beaumont, Harden Co., Texas.

It is very like a large *vultuosa*, the aperture not produced beyond the teeth as in *Henrietta*, but there is no trace of the callus connecting the parietal tooth with the angle of the peristome.

The figure on Plate I. is a fac-simile of that of Prof. Wetherby.

Triodopsis Henriettae, MAZYCK.

Treated as a var. of *T. vultuosa*, p. 313. Perhaps will prove distinct.

Shell rimately umbilicated, depressed, globose, rather solid, with numerous regular delicate striae, dark brownish horn-color; spire obtuse; whorls about five and a half, slightly convex; suture deeply impressed; beneath convex,

smoother than above ; umbilicus very deep, reaching the apex, but only exhibiting the last three whorls, grooved within ; body whorl gently ascending just behind the aperture, and then suddenly and shortly deflected, very much constricted behind the peristome, with two deep exterior pits, having the space between them elevated into a prominent ridge ; aperture subtriangular, peristome much thickened within and very slightly reflexed, very tortuous, yellowish white, furnished with a small denticle near its upper termination and an erect lamelliform tooth, which is equal in length to about one fifth the diameter of the base of the shell, extending from the lower end of the uppermost pit almost to the inner edge of the body whorl ; low down in the mouth of the shell there is, between this tooth and the denticle, a large white tongue-shaped, concave tooth ; and very near this, but rather lower down in the mouth of the shell, and on the base of the body whorl, there is an oblique stout, white tooth, which is sometimes slightly cleft on the edge. The parietal wall, which is covered with a semi-transparent callus, bears a very strong, arcuated, entering, white tooth, whose outer margins form almost a right angle.



Diameter, major, $\frac{1}{2}$ inch ; minor, $\frac{1}{16}$ inch ; altitude, $\frac{1}{4}$ inch.

Eastern Texas. Mr. Jacob Boll.

This species more nearly resembles *Helix vultuosa*, Gould, than any other North American species, but differs from that shell in the shape and size of the umbilicus and in the form and armature of the aperture, which in *vultuosa* is lunate, almost circular, and in this species is rather V-shaped ; in *vultuosa* the peristome, though moderately so, is decidedly reflexed, and its plane is almost entirely unbroken ; in *Henrietta* it is very much thickened, but scarcely at all reflexed, is very tortuous, and bears on its inner margin an obtuse denticle and a long lamelliform erect tooth, which are wanting in *vultuosa* ; in *Henrietta* the two internal teeth are so far within the aperture as to be seen only on looking into it, while in *vultuosa* they are plainly visible from the base of the side ; in the latter the parietal tooth is arched *upwards*, and its outer margin is rounded ; in *Henrietta* it takes the opposite direction, and its margins form almost a right angle ; the deep pits behind the peristome are wanting or obsolete in *vultuosa*. (Mazyck.) The species is referred to by Mr. Bland in his "Remarks," p. 116.

To the original description of Mazyck I add a figure drawn by Mr. Arthur F. Gray from the original specimen. As stated above, Mr. Bland and myself formerly considered this as a variety of *T. vultuosa*. It seems, however, quite as worthy of specific weight as *T. Copei*.

Triodopsis loricata, GOULD. (p. 313.)

Mariposa Co., California.

Triodopsis Levettei, BLAND. (p. 314.)**Plate I. Fig. E.**

Shell umbilicate, orbiculate-convex, thin, shining, translucent, slightly and irregularly obliquely striated, chestnut-colored, the upper whorls paler; spire scarcely elevated, apex obtuse; suture impressed; whorls 7, rather convex, gradually increasing; the last somewhat depressed at the aperture, obsoletely spirally striated, constricted behind the aperture, and slightly scrobiculated, base subconvex; umbilicus moderate, $\frac{1}{8}$ diameter of the shell, pervious; aperture very oblique, subcircular, with a well-developed flexuose, transverse white tooth on the parietal wall; peristome reflected, pale chestnut-colored, thickened within, the margins joined by a slight callus, the right margin with a white, obtuse, erect, submarginal tooth, the basal margin with two white transverse teeth, the upper one the larger.

Triodopsis Levettei, BLAND, Ann. N. Y. Acad. Sci., Vol. II. No. 4, p. 116, Fig. (1880).

Near Santa Fé, New Mexico, where two living and one dead specimen were collected by my friend, Dr. G. M. Levette, who presented to me one of the former. Cabinet of Dr. Levette, and the Binney and Bland collection in the American Museum of Natural History, New York.

This species is quite distinct from any known North American or other form. The number of whorls, and of teeth, their form and color, with the color of the shell and peristome, are its peculiar features. The striæ are by no means so well developed as shown in the figures. (Bland.)

The figures are copied on my plate.

Von Martens suggests that the species may be a *Polygyra*.

Mesodon. (p. 314.)

All the specific names should have the masculine termination.

Mesodon Andrewsi, W. G. BINN. (p. 324.)**Plate II. Fig. L. Plate III. Fig. E, F.**

Shell imperforate, globose, very thin, with delicate wrinkles of growth and microscopic revolving striæ; horn-color; spire elevated, conic, apex obtuse; whorls six, convex, the last greatly swollen; peristome white, thickened, slightly reflected, ends separated, the columellar one expanded. Greater diameter, 25 mm.; lesser, 20 mm.; height, 14 mm.

*Mesodon Andrews*i, W. G. BINN., Ann. N. Y. Acad. Sci., Vol. I. p. 360, Pl. XIV. Fig. E, F, Pl. XV. (1879).

Roan Mountain, Mitchell Co., North Carolina. Mrs. G. Andrews. The

absence of limestone on Roan Mountain accounts for the extreme thinness of the shell.

It can scarcely be said to resemble closely any known species of *Mesodon*, though perhaps somewhat like a gigantic *M. Mitchellianus*.

The jaw has sixteen ribs.

The lingual membrane (Pl. III. Fig. F) is long and narrow ; teeth 64-1-64, with about 15 perfect laterals on either side of the central line. There are no side cusps or cutting points to the central and lateral teeth, and only on the extreme marginals does a side cutting point appear. The cutting point of the marginals is long. Thus the dentition is like that of *clausus* and *thyroides*.

The genitalia are figured on Plate III. Fig. E. The genital bladder (*g. b.*) is large, oval, on a short, narrow duct : the penis-sac (*p. s.*) is long and stout, with a subcentral constriction : the prostate gland (*pr.*) is highly developed.

A dentate form is figured on Plate IV. Fig. A.

Mesodon Wheatleyi, BLAND. (p. 327.)

Roan Mountain, Mitchell Co., North Carolina ; Cliff Springs, Monroe Co., Tennessee. Mrs. G. Andrews. The parietal tooth was wanting in these specimens.

Mesodon dentiferus, BINNEY. (p. 328.)

Plate III. Fig. G.

On Plate III. Fig. G, I have figured the genitalia of this species.

The genital bladder (*g. b.*) is small, oval, on a short duct, which is greatly swollen at a short distance below the bladder : the penis-sac (*p. s.*) is long, stout, and contracted at a short distance below its blunt end ; the retractor is inserted in the vas deferens at about the middle of its length.

In another individual, the constriction of the penis-sac was not so well developed.

Mrs. G. Andrews found at Sugar-Loaf Mountain, North Carolina, twenty miles east of Roan Mountain, a specimen of $5\frac{1}{2}$ whorls ; greater diameter, 30 mm. ; lesser, 25 mm. ; height, 12 mm.

Mesodon Wetherbyi, BLAND. (p. 330.)

Roan Mountain, Mitchell Co., North Carolina ; Campbell Co., Tennessee, Mrs. G. Andrews. Animal uniform slate-color.

Mesodon clausus, SAY. (p. 332.)

Helix Ingallsiana. See Fischer, in Shuttleworth's Notitiæ Mal., II. 10, Pl. III. Fig. 5 (1877).

Mesodon Lawi, LEWIS. (p. 335.)

Monroe Co., East Tennessee. Mrs. G. Andrews. Houston Co., Georgia.

Mesodon devius, GOULD. (pp. 337, 432.)**Plate III. Fig. I.**

The genitalia are here figured.

The typical form was found by Mr. H. Hemphill, at Freeport, Cowlitz Co., Washington Territory.

Mesodon Sayii, BINNEY. (p. 339.)**Plate I. Fig. A, B. Plate II. Fig. K.**

An opportunity of examining the animal of this large form of *M. Sayii*, for which I am indebted to Dr. Lewis, shows that the genital system (Pl. I. Fig. B) is similar to that of the typical form, excepting that the penis-sac is still more developed, surpassing by three times the whole genital system in length. (See Vol. I., Pl. XI. Fig. 11.)

The jaw and lingual dentition are the same as in the typical *Sayii*. I have figured on Plate I. Fig. A, the dentition of this variety.

In the mountains of Tennessee and North Carolina is found the form called *var. Chiloweensis*, one of which is figured in the plate referred to (Pl. I. Fig. K).

Aglaia fidelis, GRAY. (p. 350.)

The small form from Mount Shasta, mentioned on p. 351, which also is found at the Dalles, has the same dentition and genitalia as the typical form. (See Pl. IV. Fig. G.)

There is a black variety from northern parts of California still more nearly allied to *infumata*.

Aglaia infumata, GOULD. (p. 352.)

The animal is black with brick-red tubercles. Latitude 37° 30' is said to be its southern limit. Its shell is sometimes banded. Plate IV. Fig. B, C, represent the species denuded of its hairs.

Aglaia Hillebrandi, NEWCOMB. (p. 352.)

Calaveras Co., California.

Arionta. (p. 353.)

The species are not well grouped in the text. The following is more natural: —

<i>Arionta arrosa.</i>	<i>Arionta Mormonum Traski.</i>
<i>Townsendiana.</i>	<i>Carpenteri.</i>
<i>exarata.</i>	<i>sequicola.</i>
*	<i>Diabloensis.</i>
<i>Californiensis</i> (including <i>reticulata</i>	*
<i>Nickliniana</i> , <i>ramentosa</i> , <i>Bridgesi</i>)	<i>Dupetithouarsi.</i>
*	*
<i>intercisa</i> (including <i>redimita</i>).	<i>ruficincta.</i>
*	<i>Gabbi.</i>
<i>Ayersiana.</i>	*
*	<i>Kelletti.</i>
<i>tudiculata.</i>	<i>Stearnsiana.</i>
*	

The geographical distribution of the species is very peculiar. *A. Townsendiana* belongs to the Oregon fauna. I doubt its ever having been found in Tuolumne Co., California. *A. Mormonum* belongs to the Sierra Nevada counties, as does *A. tudiculata*, which also is found in southern coast counties. All the others are restricted to the coast counties, ranging as stated in the text, the following being island species: *A. ruficincta*, *Gabbi*, *intercisa*, *Ayersiana*, and *Kelletti*. *A. Stearnsiana* and *Carpenteri* are Lower Californian species.

The lingual dentition of all the species is essentially the same, excepting *Townsendiana* and *ruficincta*, which have tricuspid centrals and inner laterals. The genitalia are the same in *arrosa*, *exarata*, *Nickliniana*, *Californiensis*, *Ayersiana*, *tudiculata*, *Traski*, *Carpenteri*, *sequicola*, *Diabloensis*, and *Dupetithouarsi*. From these the genitalia of *Mormonum* differ very essentially, being more nearly allied to that of *Aglaia fidelis* and *infumata*. *A. Townsendiana* has simple genitalia, without the accessory organs usually found in *Arionta*. *A. Kelletti* and *Stearnsiana* have the organs still more complicated with accessories. *A. ruficincta* and *Gabbi* are related by their genitalia to the last, but differ considerably in wanting the accessory duct of genital bladder.

I have not examined the genitalia of *intercisa*.

Arionta arrosa, GOULD. (p. 354.)

J. G. Cooper, in Proc. Cal. Ac. N. S., 1875, p. 16, indicates a variety, *Holderiana*, and another variety, *Stiversiana*.

Arionta Townsendiana, LEA. (p. 355.)

The variety *ptychophora* is sometimes very thin and smooth, not malleated. I have it from Salmon River, Idaho; Bitter Root Mountains; Dalles, Oregon; Umatilla Co., Oregon, (Hemphill.) (See Pl. IV. Fig. E, F.)

Arionta tudiculata, BINNEY. (p. 357.)

In the Sierra Nevada from San Diego it ranges 450 miles north. J. G. Cooper says this and *A. Mormonum* are the only large species found east of the coast range.

Dr. Cooper mentions a variety, *Franki*, in Amer. Journ. Conch., V. 209. In letters to me, however, he says this is a misprint for *Traski*.

Arionta Ayersiana, NEWCOMB. (p. 359.)

San Clemente Island. (Yates.)

Arionta intercisa, W. G. BINNEY. (p. 360.)**Plate I. Fig. I.**

Mr. Henry Hemphill has lately sent me alcoholic specimens, collected by him at San Clemente Island, California.

The jaw is as usual in the genus, with six separated ribs.

The lingual membrane is as usual in the genus. Teeth 31-1-31, with about 15 laterals on each side. The extreme laterals only are bicuspid. (Pl. I. Fig. I.)

The genitalia are like those figured by me for *Euparypha Tryoni*. (See Terr. Moll., V.)

From the series of specimens sent by Mr. Hemphill, I am inclined to believe *Arionta redimita* to be a variety of *intercisa*. The original specimen may have come from the same locality. Formerly I suspected *redimita* to be a variety of *ramentosa*.

Arionta Mormonum, PFEIFFER. (p. 366.)**Pl. I. Fig. K.**

The small form from Dalles, Oregon, is probably a small variety of *Aglaia fidelis*. Sonora, Mexico, is given as a locality of this species, from confounding the town Sonora of Tuolumne Co., California, with the Mexican state. Mormon Island is a rocky islet in the American River, seventy miles north-north-west of this town of Sonora.

A variety is indicated as *circumcarinata* by Stearns (Ann. N. Y. Acad. Sci., Vol. I. p. , Fig, 1879). A copy of two of his figures is given on Plate I. Fig. K. It is thus described by him : —

Shell widely umbilicated, discoidal, flattened, angulated, with a peripheral keel; whorls six to six and a half, slightly tabulated near the sutures, which latter are deeply impressed; surface finely granulated, varying in different specimens; and otherwise sculptured by conspicuous subacute ribs parallel with the lines of growth both above and below, which meet, and sometimes cross, the peripheral keel; these ribs are more or less irregular and uneven, of varying prominence, and are also unequally spaced, being closely crowded in some places and farther apart in others. Aperture obliquely subangulate, semilunate; peristome moderately thickened, reflected somewhat, covering the open umbilicus, and made continuous by a connecting thin deposit of callus on the labium. Color, in some specimens, dingy white to white, in others a dingy reddish white, ornamented with a double revolving band,—the upper stripe being whitish, the lower reddish or light chestnut just above, and contiguous to the peripheral keel; the pinch or fold of the keel taking up what in *Helix Mormonum* is the third or lower stripe of white.

Number of specimens four, two adult and two immature, but nearly full grown.

Greater diameter, .92 to 1.01 inches; lesser diameter, .75 to .86 inch; height, .36 to .37 inch.

Animal not observed.

Stanislaus County, near Turloch, California. (Stearns).

The form to me appears a distinct species.

Arionta Diabloensis, J. G. COOPER. (p. 369.)

The species ranges one hundred miles north of Mt. Diablo. (Cooper.)

Arionta Traski, NEWCOMB. (p. 369.)

Dr. Cooper gives its ranges from Los Angeles fifty miles to Fort Tejon, and one hundred and fifty miles to San Luis Obispo. He says the first four whorls are hirsute.

Arionta Dupetithouarsi, DESH. (p. 370.)

In the grove at Cypress Point, Monterey.

Glyptostoma Newberryanum. (p. 374.)

The under surface of a large specimen is figured on Plate IV. Fig. D.

Macroceramus Kieneri, PFEIFFER. (p. 385.)

Mr. Bland (Ann. N. Y. Acad. Sci., Vol. II. p. 127) has shown the United States specimens to be distinct under the name of *pontificus*, Gould.

Bulimulus Schiedeanus, PFEIFFER. (p. 391.)**Plate III. Fig. K.**

Jaw slightly arcuate, ends scarcely attenuated, blunt; anterior surface with 17 ribs, denticulating either margin. It is difficult to decide the exact character of these ribs. I have usually called the ribs in *Bulimulus*, *Cylindrella*, etc. narrow and widely separated. They should perhaps be described as very broad, with narrow interstices, and with a gradual increase of thickness towards their outer longitudinal margin. This plainly thickened margin is what I have formerly described as narrow ribs. In the jaw before me there is no tendency to oblique arrangement of the ribs at the upper central portion.

The lingual membrane (see plate) is long and narrow. Teeth of the same type as described by me under *Bul. dealbatus*, Say, in Vol. V.

Bulimulus multilineatus, SAY. (p. 395.)

Mexico (Fischer and Crosse).

Orthalicus undatus, BRUG. (p. 408.)

The upper figure of Plate LIV. is referred by Von Martens to *O. Ferussaci*.

Succinea ovalis, GOULD. (p. 417.)

To the synonymy add: —

S. Calumetensis, CALKINS, Valley Naturalist, Vol. I. No. 2, p. 1, with a figure. St. Louis.

SPURIOUS SPECIES OF HELICIDÆ. (p. 431.)

Clausilia acrolepia, "L'Amérique Russe" is a typographical error for "L'Arménie Russe." Zool. Rec., 1881.

In the following list I have incorporated all the foregoing additions and alterations.

CATALOGUE

OF THE

TERRESTRIAL AIR-BREATHING MOLLUSKS

OF THE UNITED STATES AND ADJACENT TERRITORIES OF NORTH AMERICA.

PULMONATA GEOPHILA.

Agnatha.

Glandina Vanuxemensis, Lea.
truncata, Gmel.
decussata, Desh.

Glandina bullata, Gld.
Texasiana, Pfr.

Holognatha Vitrinea.

Macrocyclus Vancouverensis, Lea.
sportella, Gld.
concava, Say.
Hemphilli, W. G. Binn.
Voyana, Newc.
Duranti, Newc.

Zonites Mesomphix.
capnodes, W. G. Binn.
fuliginosus, Griff.
friabilis, W. G. Binn.
Rugeli, W. G. Binn.
caduceus, Pfr.
laevigatus, Pfr.
demissus, Binn.
ligerus, Say.
intertextus, Binn.
subplanus, Binn.
inornatus, Say.
sculptilis, Bland.
Elliotti, Redf.
cerinoideus, Anth.
Hyalina.
cellarius, Müll.
Whitneyi, Newc.
nitidus, Müll.
arboreus, Say.

Zonites viridulus, Mke.
indentatus, Say.
petrophilus, Bland.
Wheatleyi, Bland.
limatulus, Ward.
minusculus, Binn.
milium, Morse.
Binneyanus, Morse.
ferreus, Morse.
conspectus, Bland.
exiguus, Stimpson.
chersinellus, Dall.
capsella, Gld.
placentula, Shuttl.
Lawi, W. G. Binn.

Conulus.

fulvus, Drap.
Fabricii, Beck.
Gundlachi, Pfr.

Gastrodonta.

gularis, Say.
cuspidatus, Lewis.
suppressus, Say.
lasmodon, Phillips.
macilentus, Shuttl.
significans, Bland.

- | | |
|-----------------------------------|--------------------------|
| Zonites Andrews, W. G. Binn. | Vitrina exilis, Morelet. |
| internus, Say. | Limax maximus, L. |
| multidentatus, Binn. | flavus, L. |
| Vitrinozonites latissimus, Lewis. | agrestis, L. |
| Vitrina limpida, Gould. | campestris, Binn. |
| • Angelicæ, Beck. | Hewstoni, J. G. Cooper. |
| Pfeifferi, Newc. | montanus, Ingersoll. |

Holognatha Helicea.

- | | |
|------------------------------------|-----------------------------|
| Patula solitaria, Say. | Pupa <i>Pupilla</i> . |
| strigosa, Gld. | muscorum, L. |
| Hemphilli, Newc. | Blandi, Morse. |
| Idahoensis, Newc. | Hoppii, Möll. |
| alternata, Say. | variolosa, Gld. |
| Cumberlandiana, Lea. | pentodon, Say. |
| perspectiva, Say. | decora, Gld. |
| Bryanti, Harper. | corpulenta, Morse. |
| striatella, Anth. | Rowelli, Newc. |
| pauper, Gld. | Californica, Rowell. |
| Horni, Gabb. | <i>Leucochila</i> . |
| asteriscus, Morse. | fallax, Say. |
| Microphysa incrustata, Poey. | modica, Gld. |
| vortex, Pfr. | Arizonensis, Gabb. |
| Lansingi, Bland. | hordeacea, Gabb. |
| Ingersolli, Bland. | armifera, Say. |
| Stearnsi, Bland. | contracta, Say. |
| Hemitrochus varians, Mke. | rupicola, Say. |
| Holospira Roemer, Pfr. | corticaria, Say. |
| Goldfussi, Mke. | pellucida, Pfr. |
| Onchidella borealis, Dall. | borealis, Morelet. |
| Carpenteri, W. G. Binn. | alticola, Ingersoll. |
| Tebennophorus Caroliniensis, Bosc. | Vertigo Gouldi, Binn. |
| Helicodiscus lineatus, Say. | Bollesiana, Morse. |
| fimbriatus, Weth. | miliun, Gld. |
| Ferussacia subcylindrica, L. | ovata, Say. |
| Cæcilianella acicula, Müll. | ventricosa, Morse. |
| Stenogyra <i>Rumina</i> . | simplex, Gld. |
| decollata, L. | Strophia incana, Binn. |
| <i>Opeas</i> . | * * |
| octonoides, C. B. Ad. | Arion fuscus, Müll. |
| subula, Pfr. | foliolatus, Gld. |
| <i>Melaniella</i> . | Ariolimax Columbianus, Gld. |
| gracillima, Pfr. | Californicus, J. G. Coop. |

- Ariolimax niger*, J. G. Coop.
 Hemphilli, W. G. Binn.
 Andersoni, J. G. Coop.
Prophysaon *Hemphilli*, Bland & Binn.
Veronicella *Floridana*, Binn.
 olivacea, Stearns.
Binneya *notabilis*, J. G. Coop.
Hemphillia *glandulosa*, Bland & Binn.
Pallifera *dorsalis*, Binn.
 Wetherbyi, W. G. Binn.
Strobila *labyrinthica*, Say.
 Hubbardi, A. D. Brown.
Gonostoma *Yatesi*, J. G. Coop.
Polygyra *auriculata*, Say.
 uvulifera, Shuttl.
 auriformis, Bland.
 Postelliana, Bland.
 espiloca, Ravenel.
 avara, Say.
 ventrosula, Pfr.
 Hindsi, Pfr.
 Texasiana, Moricand.
 triodontoides, Bland.
 Mooreana, W. G. Binn.
 hippocrepis, Pfr.
 fastigans, L. W. Say.
 Jacksoni, Bland.
 Troostiana, Lea.
 Hazardi, Bland.
 oppilata, Moricand.
 Dorfeuilliana, Lea.
 Ariadnæ, Pfr.
 septemvolva, Say.
 cereolus, Muhlf.
 Carpenteriana, Bland.
 Febigeri, Bland.
 pustula, Fer.
 pustuloides, Bland.
 leporina, Gld.
 Harfordiana, J. G. Coop.
Polygyrella *polygyrella*, Bland & J. G. Coop.
Stenotrema *spinosum*, Lea.
 labrosum, Bland.
 Edgarianum, Lea.
- Stenotrema* *Edwardsi*, Bland.
 barbigerum, Redfield.
 stenotremum, Fer.
 hirsutum, Say.
 maxillatum, Gld.
 monodon, Rack.
 germanum, Gld.
Triodopsis *palliated*, Say.
 obstricta, Say.
 appressa, Say.
 inflecta, Say.
 Rugeli, Shuttl.
 tridentata, Say.
 fallax, Say.
 introferens, Bland.
 Hopetonensis, Shuttl.
 Van Nostrandii, Bland.
 vultuosa, Gld.
 Copei, Weth.
 loricata, Gld.
 Levettei, Bld.
Mesodon *major*, Binn.
 albolabris, Say.
 divestus, Gld.
 multilineatus, Say.
 Pennsylvanicus, Green.
 Mitchellianus, Lea.
 elevatus, Say.
 Clarki, Lea.
 Christyi, Bland.
 exoletus, Binn.
 Wheatleyi, Bland.
 dentiferus, Binn.
 Roëmeri, Pfr.
 Wetherbyi, Bland.
 thyroides, Say.
 Andrewsi, W. G. Binn.
 clausus, Say.
 Columbianus, Lea.
 Downieanus, Bland.
 Lawi, Lewis.
 jejunos, Say.
 Mobilianus, Lea.
 devius, Gld.
 profundus, Say.

- Mesodon Sayii, Binn.
 Acanthinula harpa, Say.
 Vallonia pulchella, Müll.
 Fruticicola hispida, L.
 rufescens, Penn.
 Dorcasia Berlandieriana, Moric.
 griseola, Pfr.
 Turricula terrestris, Chemn.
 Aglaia fidelis, Gray.
 infumata, Gld.
 Hillebrandi, Newc.
 Arionta arrosa, Gld.
 Townsendiana, Lea.
 var. *ptychophora*, A.D. Brown.
 exarata, Pfr.
 Californiensis, Lea.
 intercisa, W. G. Binn.
 Ayresiana, Newc.
 tudiculata, Binn.
 Mormonum, Pfr.
 var. *circumcarinata*.
 Traski, Newc.
 Carpenteri, Newc.
 sequoicola, J. G. Coop.
- Arionta Diabloensis, J. G. Coop.
 Dupetithouarsi, Desh.
 ruficincta, Newc.
 Gabbi, Newc.
 Kelletti, Fbs.
 Stearnsiana, Gabb.
 Glyptostoma Newberryanum, W. G. B.
 Euparypha Tryoni, Newc.
 Tachea hortensis, Müll.
 Pomatia aspersa, Müll.
 * *
 Cyldrella Poeyana, D'Orb.
 jejuna, Gld.
 Macroceramus pontificus, Gld.
 Gossei, Pfr.
 Bulimulus patriarcha, W. G. Binn.
 alternatus, Say.
 Schiedeanus, Pfr.
 dealbatus, Say.
 serperastrus, Say.
 multilineatus, Say.
 Dormani, W. G. Binn.
 Marielinus, Poey.
 Floridanus, Pfr.

Goniognatha.

- Liguus fasciatus, Müll.
 Orthalicus undatus, Brug.
- Punctum pygmæum, Dr.

Elasmognatha.

- Succinea Haydeni, W. G. Binn.
 retusa, Lea.
 Sillimani, Bland.
 ovalis, Gld., not Say.
 Higginsii, Bland.
 Concordialis, Gld.
 luteola, Gld.
 lineata, W. G. Binn.
 avara, Say.
 Stretchiana, Bland.
 Verrilli, Bland.
 aurea, Lea.
 Groenlandica, Beck.
 obliqua, Say.
- Succinea Totteniana, Lea.
 campestris, Say.
 Hawkinsi, Baird.
 rusticana, Gld.
 Nuttalliana, Lea.
 Oregonensis, Lea.
 effusa, Shuttl.
 Salleana, Pfr.
 * *
 Haleana, Lea.
 Mooresiana, Lea.
 Grosvenori, Lea.
 Wilsoni, Lea.

EXPLANATION OF THE PLATES.

The figures of shells were drawn by Mr. Arthur F. Gray ; those of genitalia and lingual dentition,
by W. G. Binney.

PLATE I.

- Fig. A. *Mesodon Chiloweensis* : lingual dentition.
" B. " " genitalia.
" C. *Patula Bryanti*.
" D. *Helicodiscus fimbriatus*.
" E. *Triodopsis Levettei*.
" F. *Zonites petrophilus*.
" G. " *Wheatleyi*.
" H. *Vitrinozonites latissimus* : lingual dentition.
" I. *Arionta intercisa* : lingual dentition.
" J. *Triodopsis Copei*.
" K. *Arionta Mormonum*, var. *circumcarinata*.
" L. *Zonites Upsoni*.

PLATE II.

- Fig. A. *Zonites placentula*.
" B. " *macilentus*.
" C. " *cuspidatus*.
" D. " *Andrewsi*.
" E. " *Lawi*.
" F. " *multidentatus*.
" G. " *significans*.
" H. " *Rugeli* : shell.
" I. " " dentition.
" J. " *subplanus* : dentition.
" K. *Mesodon Chiloweensis*.
" L. " *Andrewsi*.
" M. *Macrocyclus Hemphilli*.
" N. *Microphysa Stearnsi* : dentition.
" O. " " jaw.

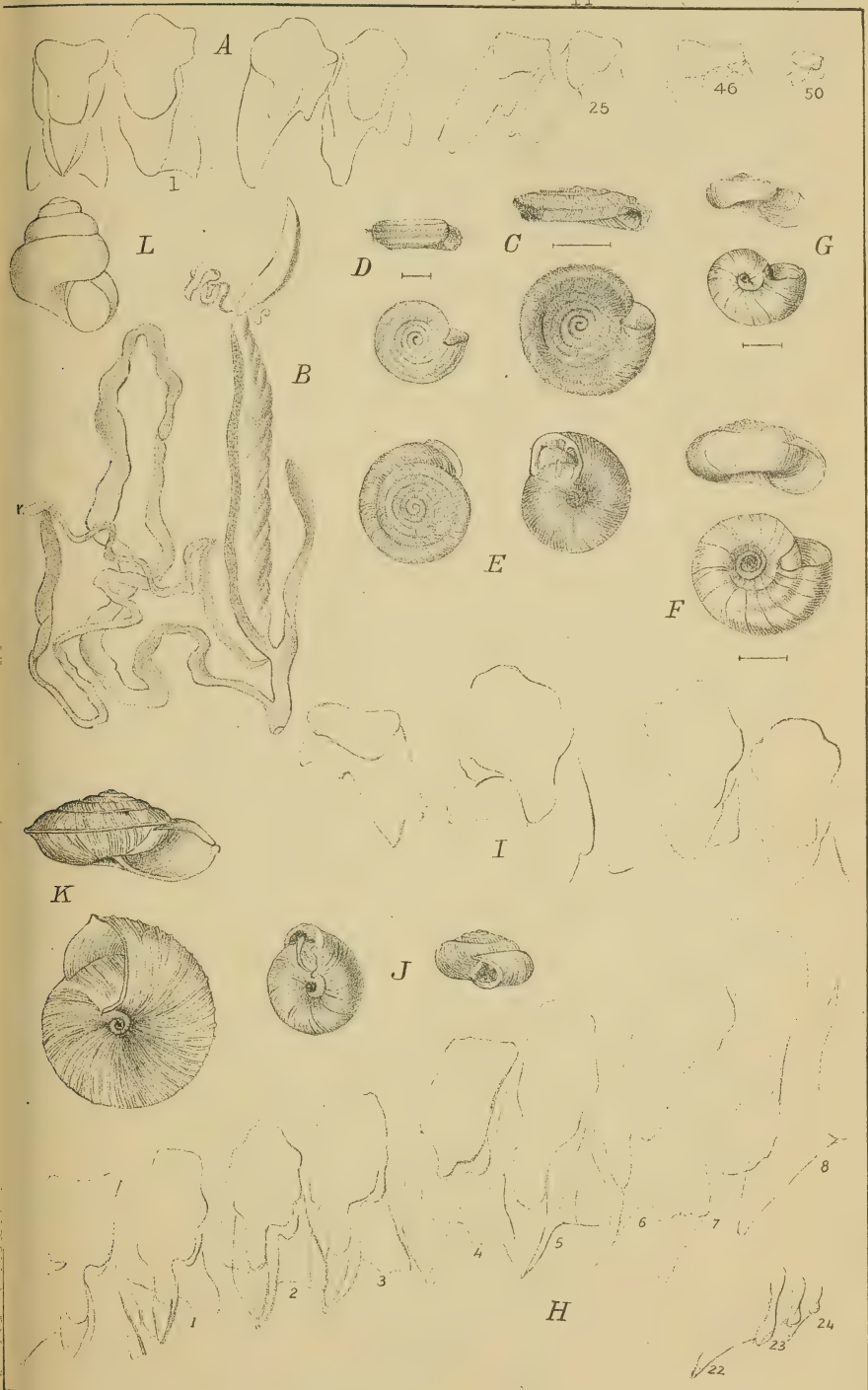
PLATE III.

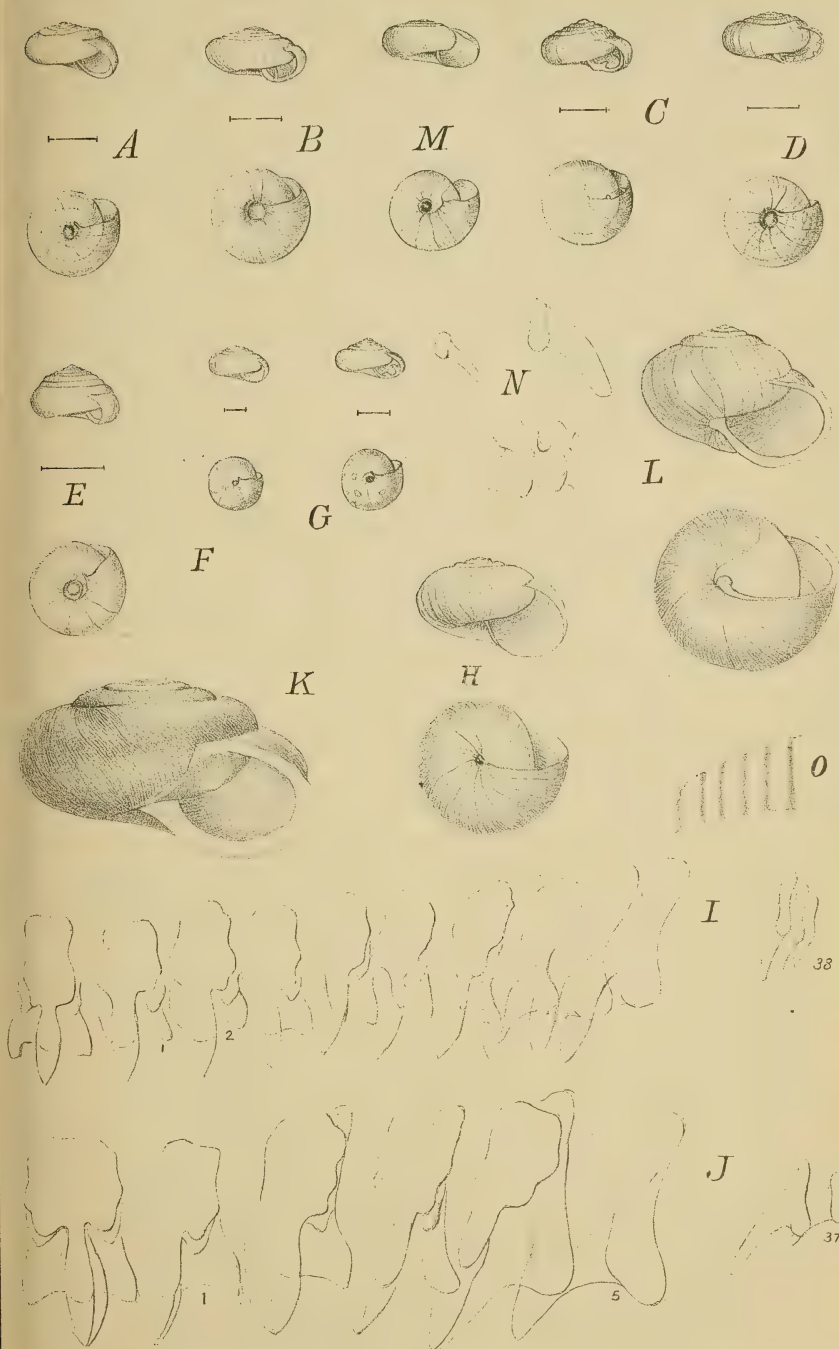
- Fig. A. Animal of *Vitrinozonites latissimus* : drawn by Miss Emma Pringle.
 " B. Genitalia of same.
 " C. " *Zonites capnodes*.
 " D. " " *Rugeli*.
 " E. " *Mesodon Andrews*.
 " F. Dentition of " "
 " G. Genitalia of *Mesodon dentiferus*.
 " H. Animal of *Hemphillia* contracted in spirits.
 " I. Genitalia of *Mesodon devius*.
 " J. Dentition of *Triodopsis vultuosa*.
 " K. " *Bulimulus Schiedeanus*.
 " L. " *Zonites Whitneyi*.

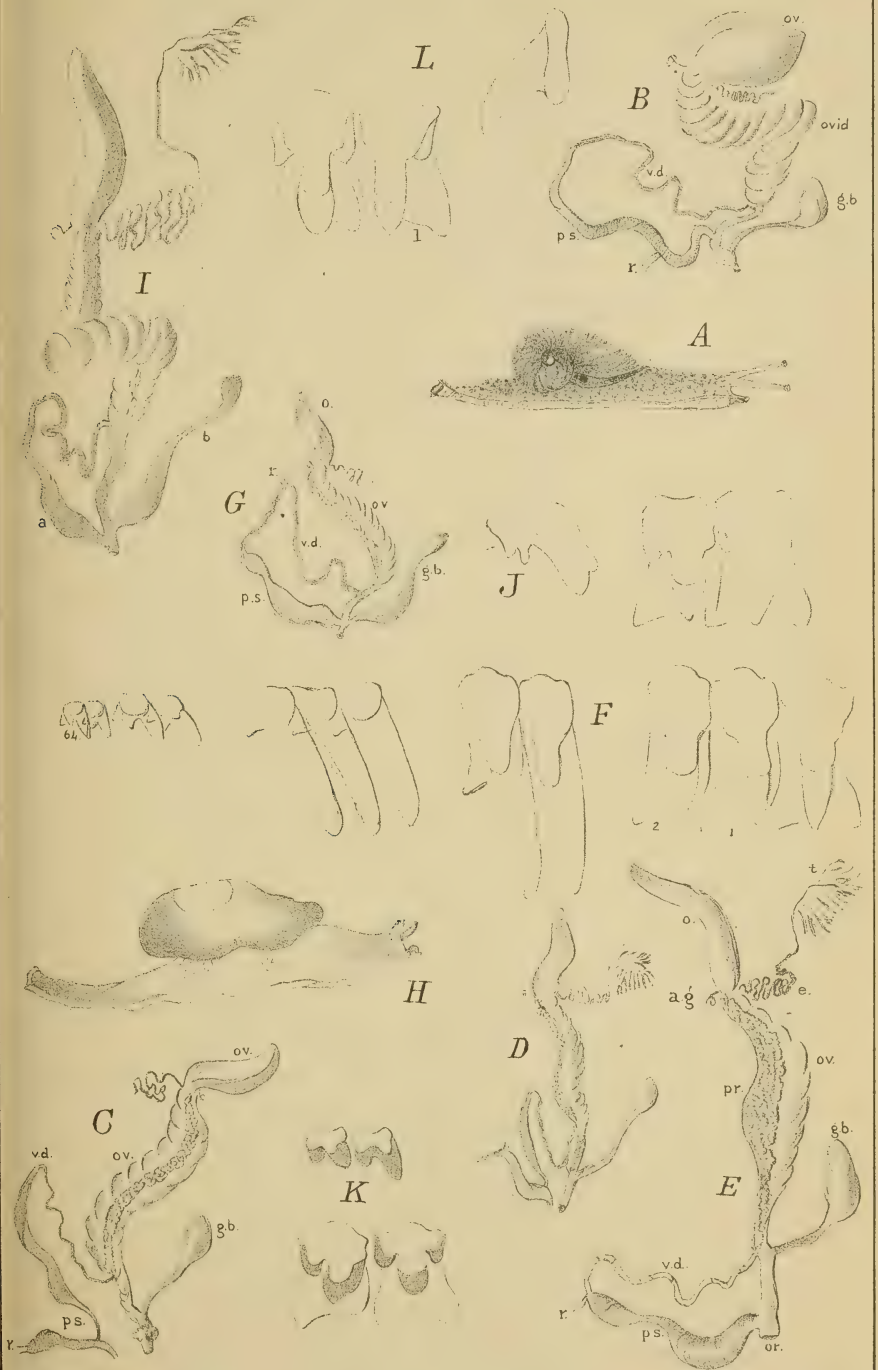
PLATE IV.

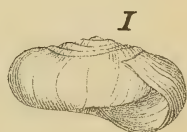
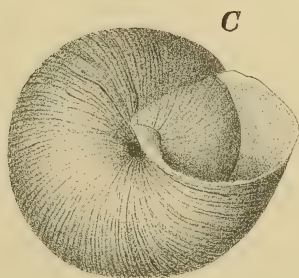
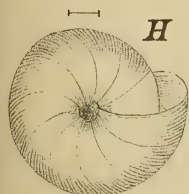
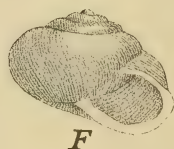
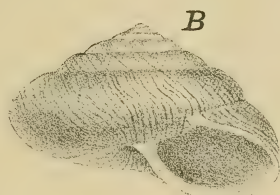
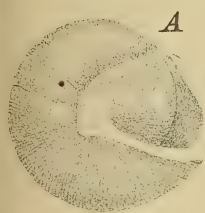
- Fig. A. *Mesodon Andrews*, *var.*
 " B, C. *Aglaia infumata*, denuded of hairs.
 " D. *Glyptostoma Newberryanum*.
 " E. *Arionta Townsendiana*, *var. ptychophora*.
 " F. " " *var.*
 " G. Fac-simile of original figures of *Hyalina subrupicola*.
 " H, I. *Aglaia fidelis*, *var.*

All but B, C, and H, I, photographed from nature.









Mr. W. H. Hall
from
W. G. Binney

Notes on the Jaw and Lingual Dentition

OF

Pulmonate Mollusks,

BY

W. G. BINNEY.

[FROM THE ANNALS OF THE NEW YORK ACADEMY OF
SCIENCES, VOL. III, NOS. 3 AND 4.]

III.—*Notes on the Jaw and Lingual Dentition of Pulmonate Mollusks.*

BY W. G. BINNEY.

Read March 3rd, 1884.

I propose in this paper to give, both in text and plates, a synoptical view of the jaws and lingual dentition of all the species of each genus which I have examined,—the descriptions and figures already published having lost a great deal of their usefulness by being scattered through the publications of many years of numerous scientific periodicals. I shall also have an opportunity to judge of the limits of variation, and of the amount of reliance to be placed on the characters of these organs for the purposes of classification,

In the fifth volume of the “Terrestrial Mollusks and Shells of the United States” (Bulletin Mus. Comp. Zool., IV), I have given an account of the various forms of lingual dentition, mode of extraction, etc., and descriptions of those organs in the genera found in the United States. These I will not repeat here; but, in order to understand the terms I use, I will state, that apparently the normal condition of the lingual membrane is to have three types of teeth: the central, the lateral and the marginal, named from their position on the lingual. Between the laterals and marginals there are generally several transition teeth, as the change is not sudden. The central tooth normally (that is, in the greatest number of species as yet examined) consists of a quadrate base of attachment (*a, b, c, d*, of pl. VII, fig. 1), with expanded lower outer angles, and the whole upper surface reflected. The reflection (*e*) is tricuspid (one median, *f*, and two

side ones, *g, h*), and each cusp is continued into a cutting point (*i, j, k*). This last I have shaded in my figures, for the purpose of distinction, but no shading exists in nature. The lateral teeth differ from the central by the suppression of the inner lower angle of the base of attachment and the inner cusp and cutting point of the tooth. Thus they are asymmetrical. As they pass outward, they become modified into marginals by the comparative enlargement of the reflection and diminution of the base of attachment, and by the splitting of each cutting point, as well as by the much diminished size of the whole tooth. This form of dentition is, as seen in my description, characterized by *quadrate marginal teeth*, from which the other large division is distinguished by having marginal teeth of a strictly *aculeate form* (see pl. II, fig. H, three left-hand teeth). For the purposes of classification, this distinction of quadrate and aculeate marginal teeth is most important. It sometimes occurs that the central (see fig. K. of pl. XVII) is missing, or the laterals are missing (fig. H, pl. XVII). When the dentition does not agree with either of these two forms, I have considered it abnormal, and described its characters, unless the genus is found in the United States, when I simply refer to my descriptions in Terr. Moll. U. S., V. It must be remembered, however, that there is some variation found from the tooth referred to on pl. VII; the side cusps and cutting points, especially, being in some genera obsolete (see all the figures on plate IX.)

A complete list of the lingual membranes examined by me is given in Bull. M. C. Z., Vol. V, No. 16, pp. 339—350. With the original description will be found the name of the person furnishing the membrane. Those from the West Indies were identified by Mr. Thomas Bland. The mounted lingual membranes will be found in the Museum of Comparative Zoölogy at Cambridge.

W. G. BINNEY,

Burlington, New Jersey.

AGNATHA.

Chlamydephorus.

Chlamydephorus Gibbonsi, W. G. Binney. Natal Colony, Africa, Mr. J. S. Gibbons.

The lingual membrane is long and broad, consisting of about 52 chevron-shaped rows of 27-1-27 teeth, all as in *Glandina*, the central one differing only in being smaller than the adjacent marginals, and symmetrical, with a long, slender cutting point; there are no laterals, all the side teeth being purely aculeate marginals, and first rapidly increasing and then gradually decreasing in size as they pass off laterally, as is usual in *Glandina*. Buccal mass very large indeed. (Pl. XVII, fig. A.)

The plate shows the central and three adjacent marginal teeth, the eighth marginal, and the twenty-third to the twenty-seventh, which is the last.

Glandina.

For the description of the dentition of the genus, see Terr. Moll. U. S., V. All the species examined by me agree with it. There are no lateral teeth.

Glandina semitarum, Rang. (*Varicella*), Martinique. Gov. Rawson.

There are about 30-1-30 teeth. The central is long, narrow, and sharply pointed. (Plate XVII, fig. C.)

Glandina Phillipsi, Ad. (*Varicella*.) Jamaica.

As in the last species; Pl. XVII, fig. D, shows an outer marginal. There is a peculiar notch in the upper edge of the base of attachment.

Glandina rosea, Fér. Nicaragua. Mr. McNiel.

Membrane with 36 rows of 25-1-25 teeth. Centrals long, narrow, slightly incurved at sides, emarginate at top, rounded at base, and bearing a short, blunt, stout, cutting point. (Pl. XVII, fig. B.)

Glandina aurata, Mor. Costa Rica, Dr. W. M. Gabb.

Referred to as an undetermined species in Ann. N. Y. Ac. Sci. I. 261.

Teeth, 36-1-36. The central tooth has a long slender cutting point. (Pl. XVII, fig. E.) The central tooth and first four marginals.

Glandina solidula, Pfr. (*Oleacina*.) New Providence.

Lingual membrane as usual in the genus.

Glandina Albersi, Pfr. Lower California.

In L. and Fr. W. Sh. of N. A., I, 19, is a figure of the dentition of this species, drawn by Mr. E. S. Morse. There are 32-1-32 teeth.

Gonospira.

Mauritius. Consul Pike.

There are no laterals. The central tooth has a short, blunt, rounded cutting-point. The marginals increase at first very rapidly in size.

G. palanga, Fér. Teeth, 37-1-37. (Pl. XVII, fig. F.) A photograph of this membrane will be found in Am. Journ. Conch., V, 37.

G. Newtoni, H. Ad. Teeth, 6-1-6. (Pl. XVII, fig. G.)

G. Mauritiana, Morel. Teeth, 12-1-12. (Pl. XVII, fig. H.)

G. modiolus, Fér. Teeth, 25 1-25.

G. Nevillei, H. Ad. Teeth, 21-1-21. (Pl. XVII, fig. I.)

G. sulcata, Müll. Lingual membrane as in the other species examined.

Ennea.

Ennea clavatula, Lam. Mauritius. Pl. XVII, fig. J. Consul Pike.

Lingual membrane as in *Gonospira*.

Spiraxis.

Spiraxis Dunkeri, Pfr. San Domingo. Mr. J. S. Gibbons.

The membrane (pl. XVII, fig. K) has no central or lateral teeth. Those present are all marginals, of the form common in *Glandina*, and arranged *en chevron*. The figure gives three on each side of the centre of the membrane.

Rhytida.

Rhytida vernicosa, Krauss. Cape Town, South Africa.

This genus also, has no central or lateral teeth. The marginals are arranged as in *Glandina*. Pl. XVII, fig. L, gives the whole of one half of one transverse row of teeth. The formula is 14-0-14. The rows of teeth are close together, not separated.

The species cannot be retained in *Pella*, a sub-genus of *Helix*, where Von Martens placed it.

Onchidium.

Onchidium Schrammi, Bl. and Binn. Pointe à Pitre, Guadeloupe. Mr. A. Schramm.

Pl. III, Fig. A. Both the teeth on each transverse row, and the rows themselves, are greatly crowded. The general arrangement of the lingual membrane is the same as I have described for that of *Onchidella* in Terr. Moll., V.

Onchidium is allied to the preceding genera merely by the absence of a jaw.

HOLOGNATHA VITRINEA.

This section includes genera furnished with a jaw in one single piece, and marginal teeth of the lingual membrane *aculeate*.

Stenopus.

Stenopus decoloratus. Demerara. Mr. J. S. Gibbons.

Jaw low, wide, slightly arcuate; ends blunt and but little attenuated; cutting-edge without median projection.

Lingual membrane (pl. XVII, fig. M) long; teeth 23-1-23, arranged *enchevron*; centrals small; upper margin elongated, tricuspid; no lateral teeth; all the side teeth are aculeate marginals; those nearest the median line somewhat modified in shape.

Not having examined a living specimen, I am not able to say whether the species has the caudal appendage characteristic of *Stenopus*.

Limax.

For description of jaw and lingual membrane, see Terr. Moll. U. S., V.

Limax semitectus, Mörch. Costa Rica. Dr. W. M. Gabb.

Jaw (pl. XV, fig. I) smooth, arched, ends attenuated; a median projection to the cutting-edge; a reinforced space on the centre of the jaw.

The lingual membrane (pl. II, fig. G) is long and narrow. There are 44-1-44 teeth. The centrals have side cusps and cutting-points. The laterals, twelve in number, on each side of the central, are bicuspid; the marginals are aculeate,—all of them are bifid by having the side spur often found on the side marginals in this genus. The 13th, 14th and 15th teeth form the transition into the marginals.

The figure gives the central, the first lateral on one side of the median line, and two marginals, the sixteenth and forty-fourth teeth.

Urocyclus.

Urocyclus Kirkii, Gray. Mozambique. Mr. J. S. Gibbons.

Jaw (pl. XVI, fig. K) very low, slightly arcuate; ends scarcely attenuated, blunt; anterior surface without ribs; no median projection to the cutting-edge; a strong muscular attachment.

Lingual membrane (pl. XVII, fig. N) with tricuspid centrals, bicuspid laterals, as in *Zonites*, and aculeate marginals, all of which are bifid.

The figure shows one central, one lateral, and two marginals.

Nanina.

The species of this genus have tricuspid centrals, bicuspid laterals, and bifid aculeate marginals. I have examined from Mauritius (Consul Pike),—

Nanina Caldwelli, Benson.

N. Rawsonis, Barclay. (Pl. II, fig. D.)

N. argentea, Rve. (Pl. II, fig. C.)

N. implicata, Nev. (Pl. II, fig. B.)

N. stylodon, Pfr.

The last cannot be retained in *Erepta*, a sub-genus of *Helix*, where it was placed by Von Martens. All the above have similar dentition. Also from Mauritius—

N. philyrina, Morelet.

Though this species agrees in other respects with the above-named, the membrane is very broad, the teeth exceedingly numerous, arranged in oblique rows. The centrals, which I am confident of having seen, are small, narrow, high. The other teeth are the same in form to the edge of the membrane. They appear to have the usual aculeate form of the marginal teeth in *Nanina*; but instead of narrowing towards the cutting-point, they are broadly and obliquely truncated, reflected, and minutely denticulated. This lingual membrane is also figured by Semper (Phil. Archip., pl. VI, f. 35); but his figures give more the impression of the usual *Nanina* marginals with denticulated side and bifid points. The teeth are, however, so exceedingly numerous and small that it is very difficult to understand them.

Nanina inversicolor, Fér.

Also from Mauritius, has the character of animal, jaw, and lingual membrane of *Nanina*, so that it cannot be retained in *Caracolus*, a sub-genus of *Helix*.

Nanina militaris,

Of same locality, for the same reasons cannot be retained in *Stylodon*, and—

Nanina leucostyla, Pfr.

Nanina rufozonata, H. Ad.

From Mauritius, prove also to belong to *Nanina*.

Nanina radians, Pfr. (*Microcystis*). Rarotonga Island.
Mr. A. Garrett.

Plate XVII, fig. P, represents one central, lateral and marginal tooth. There are 40-1-40 teeth, eight on each side being perfectly formed laterals. The marginals are sometimes trifid.

Nanina conula, Pease. Island of Huahine. Mr. A. Garrett.

Central and lateral teeth as in *N. radians*, Pfr. (See above.) Lateral teeth, seven in number on each side. Marginals aculeate, multifid, very numerous.

Nanina calculosa, Gould. Island of Huahine. Mr. A. Garrett.

Jaw as usual in the genus. Lingual membrane long and narrow. Teeth, 38-1-38. Centrals and (7) laterals as in *N. radians*. (See above.) The latter, however, have slightly developed inner side cutting points. First 15 marginals bifid, the rest multifid.

Nanina Cressida, Gould. Island of Huahine. Mr. A. Garrett.

Jaw arched, high; ends blunt; cutting-margin with a median beak-like projection.

Lingual membrane (Pl. XVII, fig. Q) with 55-1-55 teeth. The bifurcation of the cutting-point of the marginals commences in the 11th tooth. There are no side cusps to the centrals and laterals, which have a long, narrow base of attachment on each side. I figure one central, one lateral and one marginal tooth.

Nanina Chamoissi, Pfr. West Maui, Sandwich Islands.
Gulick.

Pl. XVII, fig. O. The marginal teeth have three or four points. An unidentified species from Oahu has similar dentition.

Nanina subcircula, Mousson. Raiatea, Society Islands. Mr. Garrett.

Lingual membrane (Pl. II, fig. A) as in the other species.

Nanina cultrata, Gould.

Lingual membrane as usual in the genus. Laterals six on both sides; extreme marginals multifid.

Nanina Calias, Benson. Foot of Himalayas. Mus. Comp. Zool.

Lingual membrane with ten laterals on each side, still more bifid marginals. (Pl. II, fig. E.) On the same plate, fig. F, is figured a central tooth from another part of the same membrane, in which the cutting point is abnormally developed.

Velifera.

Known only by the single species, *V. Gabbi*, Costa Rica. Dr. W. M. Gabb.

Jaw with smooth anterior surface and beak-like projection to the cutting edge.

Lingual membrane (Pl. II, fig. H) with the general arrangement of *Zonites*; the first laterals have an inner side cutting point; marginals aculeate, with side spur.

Its lingual membrane resembles that of *Limax agrestis*, in having the inner, abnormal side cutting point to its first lateral teeth. All the marginals are bifid.

Macrocyclus.

Macrocyclus Baudoni, Petit. Guadeloupe, Mr. Schramm; Dominica, Mr. Guppy.

Jaw delicate, transparent, colorless; ends pointed; anterior surface smooth; cutting edge with median projection.

Lingual membrane as in *Macrocyclus*. (See Terr. Moll., V.) I could not distinguish the characters of the very small central tooth.

Macrocyclus euspira, Pfr. Placed in *Ammonoceras*, a subgenus of *Hyalina*, by von Martens, but, from its lingual membrane, shown to belong to *Macrocyclus*.

Jaw low, crescentic; ends pointed; cutting margin with a decided, sharp, median projection.

Lingual membrane (pl. II, fig. I) long and narrow; teeth arranged as in *Macrocyclus*. There are, however, no transition teeth, as in the American species; all the side teeth being true marginals of the aculeate type. Teeth, 30-1-30. The centrals are deeply emarginate at the upper edge of their base of attachment, and have expanded lower lateral angles; they have also a well-marked, simple, median cusp, with a decided cutting point.

Zonites. (See Terr. Moll., V.)

Zonites? Bermudensis. Pfr. Bermuda. Mr. J. J. Crooke; Mr. J. Matthew Jones.

Jaw extremely thin, arched, with a blunt, median projection to its cutting edge.

Lingual membrane long and narrow. Central teeth tricuspid; laterals bicuspid; the cusps in each long and slender. Marginals numerous, aculeate, in oblique rows.

The result of my examination of the lingual membrane throws light on the generic position of this species. It can no longer be retained in *Caracolus*, a sub-genus of *Helix*, as proposed by von Martens, since it has the dentition of the *Vitrinea* of von Martens' arrangement. It differs, however, from *Zonites*, in having no longitudinal furrows above the margin of the foot, and no caudal mucus-pore. It seems to belong to no described genus.

Janulus.

Janulus stephanophora, Desh. Madeira. Dr. Hillebrand.

Jaw strongly arched; ends pointed; cutting margin with a sharp, greatly produced median projection.

Janulus bifrons, Lowe. Madeira. Dr. Hillebrand.

Jaw smooth, with median projection.

Lingual membrane with 34-1-34 teeth, of which four on each side are laterals, all as in *Zonites*.

HOLOGNATHA HELICEA.

This section contains the genera furnished with a jaw in one single piece, and quadrate marginal teeth to the lingual membrane.

A. JAW RIBLESS.

I still retain this section, though several species in various genera have ribs on their jaw.

Tebennophorus. (See Terr. Moll., V.)

Tebennophorus Costaricensis, Mörch. Costa Rica. Dr. W. M. Gabb.

Jaw strongly arched, of equal width to its blunt extremities. There are sub-obsolete anterior ribs about the centre of the jaw, the ends of five of which denticulate the cutting margin.

The lingual dentition is figured on Plate VIII, fig. N. There are about 28-1-28 teeth. The centrals have a long base of attachment, with a strong line of reinforcement running parallel to its margin at the lower edge and for a short distance at the sides. The reflection is small, and bears a short, stout median cusp, and small stout side cusps; all three cusps bearing short, stout cutting points. The lateral teeth are like the centrals, but asymmetrical by the suppression of the inner cusp and cutting point and the inner lower expansion of the base of attachment. The marginals are but a modification of the laterals; the inner cutting point not becoming bifid, though the outer one is so on the extreme marginals. There are hardly more than twelve perfect laterals on each side. The change into marginals is very gradual.

Sagda.

Sagda connectens, Ad. Jamaica. Mr. Jas. Milligen.

Lingual membrane with 26-1-26 teeth. The centrals have their plates short in comparison to the reflection, and broad. The middle cusp is long, with a long slender point. The side cusps are sub-obsolete, with short, acute, triangular points. The laterals are of the same type as centrals, but bicuspid, the outer cusp more developed than the external cusps of the centrals. The marginals are wide, low, with one long, oblique, blunt, narrow inner cusp, and one or more side small cusps.

The genus is included in the *Vitrinea* of von Martens; but I have shown that it belongs to the *Helicea*, the marginal teeth being quadrate, not aculeate.

Sagda Haldemaniana, Jay. Jamaica. Messrs. Gloyne and Vendreyes.

Jaw slightly arcuate, of almost equal height throughout; ends blunt; no anterior ribs; no median projection to the cutting edge.

Lingual membrane with about 30-1-30 teeth, as in the last species. (Pl. II, fig. K.)

Sagda Jayana, Ad. Jamaica. Mr. Henry Vendreyes.

Jaw smooth; scarcely any median projection to cutting edge.

Lingual membrane with teeth characterized as in last species.

Endodonta.

I regret not succeeding in obtaining the jaw of any species of this genus, the more because some doubt of its existence has been expressed. It is, however, probable that it will be found, as no agnathous genus has yet been noticed with the quadrate marginal teeth which characterize *E. incerta*, and also *E. tumuloides*, Garrett.

Endodonta incerta, Mousson. Huahine Island. Mr. A. Garrett.

Lingual membrane (Pl. II, fig. N) with 11-1-11 teeth, of which four on each side are perfect laterals. The marginals (of which the last is shown in the figure) are but a simple modification of the laterals. They differ from those of *tumuloides* in not having a bifid inner cutting point, unless indeed I have, from their exceeding minuteness, failed rightly to interpret them.

Endodonta tumuloides, Garrett. Rarotonga Island, Cook's Island. Mr. Garrett.

Lingual membrane (Pl. II, fig. M) with 17-1-17 teeth, with about seven perfect laterals on each side. Teeth as in last species; but the inner cutting point of the marginals is bifid.

Patula.

Patula Huahinensis, Pfr. Huahine Island. Mr. A. Garrett.

Jaw not examined.

Lingual membrane with 18-1-18 teeth, of which about six on each side are laterals. The type of dentition is about the same as in *Endodonta incerta*, described above. The marginals are, however, different, the two cutting points being bifid, the base of attachment low and wide. (Plate II, fig. L.)

Pella.

The character of the jaw does not allow the genus to hold a position here, among "ribless jaws."

Pella rariplicata, Benson. Cape Town, S. Africa. Mr. J. S. Gibbons.

The jaw has flat, crowded, numerous ribs, such as I have described for *Microphysa Lansingi*, in Terr. Moll., V.

Lingual membrane (Pl. III, fig. I) long and narrow. About 16-1-16 teeth, with four laterals on each side of the central tooth. The central tooth has small side cusps and cutting points. Laterals like the centrals, but slightly asymmetrical by the lesser development of the inner side; an unusual arrangement in the *Helicidae*. The marginals are low, wide, with one inner, wide, bifid cutting point, and one smaller, bifid outer cutting point, giving a serrated appearance to the cutting edge.

A central tooth, with its adjacent laterals, and two marginal teeth, are given in the figure.

Polymita.

Having found two different forms of dentition in the species referred by Von Martens to *Polymita*, I propose to restrict this genus to those species which have the abnormal dentition of its type, *P. muscarum*, leaving those with the usual dentition of the *Helicidae* under the name of *Hemitrochus*.

The peculiar dentition of *Polymita*, entirely unexpected from the appearance of the shell, is one of the most interesting facts I have met with. It is not only different from that of its allied forms, but also from that of all species of the Pfeifferian genus *Helix* as yet examined.

The peculiar dentition is shared by *picta*, Born, and may be looked for in *sulphureosa*, Morelet. These two species are placed by von Martens, in *Liochila*, together with *Helix Jamaicensis*. The two former I put with *muscarum* in *Polymita*. For the last, see below.

Polymita muscarum, Lea.

Jaw wide, low, arched, delicately striated; ends attenuated, bluntly rounded; no anterior ribs; no median projection to the cutting edge. (Pl. XV, fig. K.)

Lingual membrane long and narrow, composed of numerous rows of about 75-1-75 teeth each. The transverse rows are arranged *en chevron*. Centrals with base of attachment long, narrow, incurving at the sides; upper margin slightly rounded; lower margin trilobed and fringed; on the lower fourth of the base of attachment springs a trilobed, gouge-shaped, cutting edge, broader than the base, and bearing three cusps, each produced into a cutting point, the central triangular, the external ones curving outwards, neither produced beyond the lower margin of the base of attachment. The side teeth (which do not resemble the usual form either of laterals or marginals) are of the same form as the centrals, but rendered asymmetrical by the lesser development of the inner lower angle of the base of attachment, and by its being thrown abruptly off towards the margin of the membrane; the lower edge is also rounded, and not trilobed as in the centrals; the laterals, also, are longer, narrower, with a less expanded upper margin of the base of attachment than in the centrals, in a contrary direction from which they are also thrown off by the irregular curving of the base of attachment. The cusps and cutting points of the side teeth are like those of the centrals.

In one lingual membrane examined, I noticed two abnormal rows of teeth down the whole length of the membrane, in which the cutting edge was divided into four lobes, instead of three, all bearing cutting points. These abnormal lines of teeth were separated by a normal line.

The figure (Pl. III, fig. C) shows a group of central and side teeth, while a single central, still more enlarged, is shown in D.

These peculiar, long, subquadrangular bases of attachment, not reflected along the upper margin, as usual in the *Helicidae*, but bearing the gouge-shaped, expanded cutting edge, soldered as it were upon its surface, can only be compared to those of *Gæotis*, and those of the marginal teeth of *Orthalicus* and *Liguus*.

Polymita picta, Born. Cuba. The specimen examined was found on a bunch of bananas in New York.

Jaw as in *muscarum*.

Lingual membrane (Pl. III, fig. E) with the same characteristics as that of *muscarum*; but the teeth are shorter and stouter. (Plate III, fig. E.)

HEMITROCHUS.

I have examined only five species of those remaining in von Martens' *Polymita*, after removing its type, *muscarum*, as explained above. *Helix versicolor*, Born, is the only remaining

species in which the dentition of *muscarum* and *picta* may be looked for. The others will probably agree with *varians*, etc.

The jaw of *varians*, *gallopavonis*, *Troscheli*, *rufoapicata*, *graminicola*, is high, arched, without ribs, with a blunt median projection. In one species, *Milleri*, the jaw is like this, excepting that it has one decided, stout, central rib, denticulating either margin. This shows that the presence or absence of ribs on the jaw cannot be considered a reliable generic character. (See, also, *Dentellaria*.)

Hemitrochus varians, Mke. (See Terr. Moll., V.)

Hemitrochus Troscheli, Pfr. New Providence, Bahamas. Gov. Rawson.

Jaw as described ; a strong, transverse line of re-enforcement.

Lingual membrane (Pl. IV, fig. A) long and narrow. Central teeth very long ; the upper margin of base of attachment greatly produced above ; the reflected portion not extending to the lower margin ; median cusp with a short, blunt cutting point ; side cusps and cutting points obsolete. Laterals like the centrals, but asymmetrical ; the upper margin still more produced ; outer laterals with bifid inner cutting point, and side cusp and cutting point. Marginals quadrate, with one large, oblique, rounded, bluntly bifid cutting point, and one or two side, small, blunt cutting points. The membrane is peculiar in the extension of the upper margin of the base of attachment of the teeth.

Hemitrochus gallopavonis, Val. Turk's Island. Gov. Rawson.

Jaw as described.

Lingual membrane as described in last species. (Pl. IV, fig. B.)

Hemitrochus rufoapicata, Poey. Cuba. Mr. Arango.

Jaw and lingual membrane (Pl. IV, fig. C) as described above.

Hemitrochus graminicola, Ad. Jamaica. Messrs. Vendreyes and Gloyne.

Jaw as described.

Lingual membrane (Pl. IV, fig. E) as described. Teeth 40-1-40.

Of the above species, the figure gives one central, the adjacent lateral or laterals, and one or more marginals.

Hemitrochus Milleri, Pfr. Fortune Island, Bahamas. Dr. J. J. Brown.

Jaw differing from that of the above species by the presence of a stout,

median rib-like prominence, denticulating either margin. (Pl. XVI, fig. J.) See above, under generic name.

Lingual membrane with 33-1-33 teeth, characterized as in the other species. Fig. D, of pl. IV, shows one central and adjacent lateral, an outer lateral (7th tooth) showing the side cusp and cutting point; the eighth lateral, in which the inner cutting point first is bifid, the sixteenth tooth, still a lateral, though somewhat modified in form, and a marginal, the last tooth. It will be noticed that, on the central and first lateral, the cutting point has a side bulging, probably a modification of the missing side cutting point. No doubt this bulging exists in the other species of the genus, though not shown in the focus under which my figures were drawn.

Acavus.

Acavus Phoenix, Pfr.

Jaw wide, low, arcuate; ends but slightly attenuated, blunt, very thick and coarse; no anterior ribs; no median prominence to the cutting edge.

Lingual membrane (Pl. II, fig. O) with long and narrow centrals and laterals; the upper margin of the base of attachment produced and rounded; the reflection is stout, as are the cusp and cutting point, of which only the middle one exists. Marginal teeth simply a modification of the laterals.

Caracolus.

In this genus, also, there is a difference as regards the presence or absence of ribs on the jaw.

Lingual membrane characterized by the absence of side cusps and cutting points.

Caracolus Bermudensis, of von Martens' list, I have above shown to be more nearly allied to *Zonites* than to any known genus. *Caracolus inversicolor* I have above referred to *Nanina*.

Caracolus excellens, Pfr. San Domingo. Dr. Newcomb.

Jaw not examined.

Lingual membrane (Pl. IV, fig. F).

Caracolus sagemon, Beck. Cuba. Mr. Arango.

Jaw high, arcuate; ends rapidly but slightly attenuated, blunt; cutting margin with broad, blunt, median projection; no anterior ribs.

Lingual membrane (Pl. IV, fig. G) very long and narrow, with 36-1-36 teeth; the transverse rows of teeth being unusually oblique, though not so represented in my figure. The change from laterals to marginals is very gradual, so that it is difficult to count the former. Centrals with base of attachment long, constricted at the middle, expanded above, and with greatly produced lower lateral angles; reflection large, with obsolete side

cusps and no side cutting points, and with a very broad, short median cusp, bearing a short, widely-expanded, square edge (as it cannot be called a point). Laterals like the centrals, but asymmetrical, as usual, and with an asymmetrical cutting edge larger than in the central tooth. The cutting edge becomes more developed as the teeth pass off laterally, in proportion to the base of attachment and the cusp also. Thus the marginals become formed without any splitting of the inner cutting point, or any development of a side cusp and cutting point, excepting that on some of the teeth a blunt obsolete side cusp may be shown.

The form of this species from Gonave Island, Haiti, (Prof. Linden,) is said by Mr. Bland to have a white, instead of a reddish-brown, peristome. The lingual membrane is figured on Pl. IV, fig. H. The cutting points on all the teeth are more produced than in the Cuban *sagemon* and *Arangiana*; after the eighth tooth there is a decided side cutting point on the laterals and marginals. The jaw is the same as in *sagemon*.

Caracolus Arangiana, Poey. Cuba. Mr. Arango.

Jaw (Pl. XV, fig. M) greatly arched; ends blunt, scarcely attenuated; cutting margin with a blunt, median projection.

Lingual membrane (Pl. IV, fig. I) with 33-1-33 teeth, arranged as in *sagemon*. The lower margin of the base of attachment seems delicately fringed.

Caracolus marginella, Gmelin. Porto Rico. Mr. R. Swift.

The jaw differs from that of the other species examined, in having stout anterior ribs.

Lingual membrane (Pl. IV, fig. J).

Leucochroa.

The genus *Leucochroa* is adopted by von Martens, the type being *Helix candidissima*, Drap., a species whose anatomy has been described by Moquin-Tandon as being more nearly related to *Zonites* than to *Helix*. The genus is classed by von Martens among the *Vitrinea*, the section of *Helicea* containing the genera furnished with ribless anterior surface and median projection to the jaw, and aculeate, marginal teeth to the lingual membrane. Among the species catalogued by von Martens is *Leucochroa Boissieri*, Charp. We find, however, that both jaw and lingual membrane in this species indicate that the genus belongs to the *Helicea*.

Leucochroa Boissieri, Charp. Palestine. Mr. John Van Nostrand.

Jaw very low, long, arcuate; ends but little attenuated, bluntly rounded; cutting edge with a decided median projection; anterior surface free from

ribs, with a strong transverse line of reinforcement. The jaw resembles that of *Clausilia* or *Pupa* more than that usually found in *Helix*.

Lingual membrane as usual in the *Helicidae*. Centrals short and stout, with a blunt cutting point to the central tooth; the cusps obsolete. Laterals with a very long, oblique, blunt inner cutting point; the outer cutting point obsolete. Marginals subquadrate, with several short, blunt, cutting points. (Pl. II, fig. J.)

Ochthephila.

In this genus, again, the presence or absence of ribs on the jaw is not a reliable character.

Ochthephila tiarella, Webb and Broll. Madeira. Dr. Hillebrand.

Jaw low, slightly arcuate; ends scarcely attenuated; anterior surface with about 15 flat, broad, crowded ribs, scarcely denticulating the cutting margin.

Lingual membrane with 21-1-21 teeth, of same character as figured in *Plebecula lurida*. About nine laterals on each side of the median line.

Ochthephila abjecta, Low. Madeira. Dr. Hillebrand.

Jaw low, slightly arcuate; ends attenuated; cutting edge with a blunt median projection; no anterior ribs.

Lingual membrane with 24-1-24 teeth, about four on each side being perfect laterals, characterized as in the last species.

Cysticopsis.

The jaw described under *C. tumida* is peculiar. There is considerable difference in the dentition of the two species examined.

Cysticopsis tumida, Pfr.

Jaw (Pl. XVI, fig. A) wide, low, slightly arcuate, scarcely attenuated at the blunt ends; a slight, broad, median projection to the cutting edge; with delicate, separated, longitudinal striæ, passing into a long, narrowing, conical prolongation of the jaw, springing from about the centre of its surface, and distinct from the muscular attachment of the jaw.

Lingual membrane (Pl. V, fig. A) with 22-1-22 teeth. Centrals very broad, with a small reflection bearing three distinct cusps and cutting points. Laterals like the centrals, but bicuspid and asymmetrical. Marginals low, wide, with one inner, larger, cutting point, and one outer, smaller, bifid cutting point.

Cysticopsis pemphigodes, Pfr. Cuba.

Jaw not examined.

Lingual membrane (Pl. V, fig. B) long and broad. Teeth as in *Plagiop. tycha*, not as in *Cysticopsis tumida*.

Plagioptycha.

Jaw arcuate, ends slightly acuminate, blunt; no anterior ribs; a decided median projection to the cutting edge:—*P. loxodon*, Pfr., *Albersiana*, Pfr., *monodonta*, Pfr., *diaphana*, Lam., *macroglossa*, Pfr. In *P. Duclosiana*, Fér., however, there is a decided median, stout rib, denticulating either margin. Thus the presence or absence of ribs on the jaw cannot be considered a generic character in *Plagioptycha*.

The character of the lingual dentition in the species examined agrees.

Plagioptycha loxodon, Fér. San Domingo. Dr. W. Newcomb.

Lingual membrane (Pl. V, fig. C) long and narrow. Centrals having a long, narrow base of attachment, with expanded lower angles and lines of reinforcement within them; reflected portion small, with a single stout cusp and cutting point; laterals like centrals, but asymmetrical; outer laterals with outer cusp and cutting point; the inner cutting point becomes bifid as the teeth pass into marginals, which become low and wide, with two broad, bluntly rounded, usually bluntly bifid cutting points.

Plagioptycha Albersiana, Pfr.

Jaw as above.

Lingual membrane like last. (Pl. V, fig. D.)

Plagioptycha monodonta, Pfr. San Domingo. Dr. Newcomb.

Jaw as above.

Lingual membrane (Pl. V, fig. E) like that of *P. loxodon*.

Plagioptycha Duclosiana, Fér. Exuma, Bahamas. Dr. J. J. Brown.

Jaw as described above.

Lingual membrane (Pl. V, fig. F) with about 30-1-30 teeth. The figure shows the gradual changes in the teeth, the seventh being the last lateral. The side bulgings in the cutting points of central and first laterals are shown by using a different focus in the microscope than that used in drawing the figures of the other species. It represents the side cutting point.

Plagioptycha diaphana, Lam. Porto Rico. Dr. Cleve.

Jaw as above.

Lingual membrane (Pl. V, fig. G) as in *loxodon*.

Plagioptycha macroglossa, Pfr.

Jaw as above.

Lingual dentition (Pl. V, fig. H) as in *loxodon*.

Leptoloma.

Only one species examined :—

Leptoloma fuscocincta, Ad. Jamaica.

Jaw thin, arcuate, high, ends bluntly truncated; with perpendicular striæ; cutting edge with a median projection.

Lingual membrane (Pl. V, fig. I) as in *Plagioptycha*.

Achatinella.

In Annals of Lyceum of Nat. Hist. of New York, X, 331; XI, 190, are given in detail my observations on the anatomy of *Achatinella*. I here give a summary only of what relates to the jaw and lingual dentition.

Most of the specimens examined were sent by Mr. Gulick. A few were received from the Museum of Comparative Zoölogy.

I have here grouped the species according to von Martens' arrangement and sub-genera. I will state that, of Mr. Gulick's arrangement, the species examined represent the sub-genera—*Achatinella*, *Bulimella*, *Apex*, *Partulina*, *Auriculella*, *Laminella*, *Amastra*, *Leptachatina*,—all except *Newcombia*: *Carelia* is treated below.

The result of my examination may be briefly stated, viz.: that I find two types of dentition, one (*a*) including the species of *Partulina* and *Achatinella*, s. s.; the second (*b*) comprising all the species examined, of *Newcombia*, *Laminella*, *Leptachatina*.

Bulimella, *Apex* and *Labiella*, of von Martens' arrangement, were not examined. Of these we may expect to find the first two agreeing with my first section (*a*) in dentition; the last, with my second (*b*).

In the section (*a*) suggested by me, the species are all characterized by a jaw so extremely delicate as to be found with great difficulty. It cannot be extracted by potash. It is arcuate, extremely thin, transparent, with blunt ends. The lingual membrane agrees with that figured by Heynemann of *A. bulinoides*. It is very broad in comparison to its length. In one lingual there were 175-1-175 teeth. They are arranged *en chevron*. There is but one form of tooth for centrals and side teeth (it is difficult to call the latter laterals or marginals), but the centrals are somewhat smaller and symmetrical. The base of attachment

is long and narrow, squarely truncated below, rapidly widening and curving outwards at its upper third, so that the upper margin is twice the breadth of the lower; it is rounded and reflected along its whole breadth; reflection small, bearing five or more cusps and cutting points, the median the smallest. There is some variation in these cusps. Of this type of jaw and dentition are:—

- Partulina jucunda*, Smith. W. Maui.
plumbea, Gulick. E. Maui.
eburnea, Gulick. E. Maui.
solidissima, Smith. E. Maui.
solida, Gulick. Oahu.
tæniolata, Pfr. Oahu.
marmorata, Gld. Oahu.
pallida, Nutt. Oahu.

- Achatinella* (s. s.) *producta*, Rve. Oahu. (Pl. III, fig. G.)
Johnsonii, Newc. Oahu.
livida, Swains. Oahu.
varia, Gulick. Oahu.
auricula, Fér.

In the last three species, I failed to extract the delicate jaw. *Achatinella auricula*, Fér., on account of its having this type of dentition, I remove from *Partula*, where it is placed by von Martens.

The peculiar type of dentition shared by the above species is seen on my Pl. III, fig. G. (*A. producta*, Rve.)

(b) Of the second type of jaw and dentition are the remainder of the species examined. The jaw is stout, arcuate, ends blunt, no anterior ribs; generally a median projection to cutting edge. In *Laminella Mastersi* it is low, wide, slightly arcuate, horn-colored; no median projection. (Pl. XVI, fig. E.) It is the same in the other species of *Laminella*. The same type of jaw, though more arched, is found in all the species of *Newcombia* and *Leptachatina*. In *picta* (Pl. XVI, fig. M) there is a slightly produced, blunt, median projection to the cutting edge. There are often delicate vertical striæ on this type of jaw.

The lingual dentition in this section is entirely different from that in the last. The membrane is long and narrow. The transverse rows of teeth are horizontal, not *en chevron*. The teeth are like those usually found in the *Pulmonata*, with quadrate base of attachment and tricuspid centrals, bicuspid laterals, bicuspid, multicuspid, or even pectinate marginals. The centrals are very much smaller than the laterals, both in height and width.

Newcombia picta, Mighels. W. Maui.

Jaw described above. Lingual membrane, Pl. VI, fig. B. The marginals have two cutting points, each point becoming bifid as the teeth pass off laterally.

Newcombia venusta, Mighels.

Jaw slightly arcuate, with blunt ends; a few vertical wrinkles.

Lingual membrane (Pl. VI, fig. A) shown in all its changes. The marginals are decidedly pectinate in the teeth figured, but some are seen with only two cutting points. Teeth 24-1-24, eight being laterals on each side of the median line.

Laminella Mastersi, Newc. West and East Maui.

Jaw described above. (Pl. XVI, fig. E.)

Lingual membrane (Pl. VI, fig. E) with simply two or three cutting points to the marginals. A group of these latter, and of centrals and laterals, is given.

Laminella obesa, Newc.

Lingual membrane (Pl. VI, fig. C) with 27-1-27 teeth, of same type as in the last species.

The tooth shown in the figure is the 19th, a marginal, with one large, inner cutting point, and three very small outer ones. On the same membrane, however, are some marginals having three cutting points and some which are quite pectinate. This variation shows that my distinction between *b* and *c*, in my former paper, referred to above, was not well founded.

The jaw is as in *A. Mastersi*.

Laminella decorticata, Gulick. Oahu.

Lingual membrane (Pl. VI, fig. D) as in *Mastersi*.

Laminella luctuosa, Pfr. Oahu.

Lingual membrane (Pl. VI, fig. F) as in *Mastersi*.

Laminella nigrolabris, Smith. Oahu.

Lingual membrane as in *Mastersi*.

Leptachatina nitida, Newc. W. Maui.

Lingual membrane (Pl. VI, fig. H), marginals pectinate.

Leptachatina grana, Newc. W. Maui.

Dentition as in last species.

Leptachatina dimidiata, Pfr. Oahu.

Same dentition.

Leptachatina textilis, Fér.

The dentition is as in the other species of the subgenus examined by me. There are 26-1-26 teeth, with eight laterals on each side. On Pl. VI, fig. G, I figure the whole change from central to extreme marginal teeth. The last are not pectinate.

Tornatellina.

Considered by von Martens as a sub-genus of *Cionella*, but by its dentition closely related to *Achatinella*, s. s. The jaw was not examined.

Tornatellina aperta, Pease. Huahine Island. Mr. A. Garrett.

Lingual membrane (Pl. III, fig. F). The figure represents the central, with the first and second side teeth. There is an exceedingly large number of teeth beyond this, of the same type, quite to the exterior margin of the membrane. The teeth are arranged obliquely in waving rows, as is also the case in *Achatinella*, s. s. Teeth of same type as those of *Achatinella*, s. s.

Tornatellina oblonga, Pease. Huahine Island. Mr. A. Garrett.

Lingual dentition the same as in the preceding species.

Clausilia.

The West Indian species alone examined.

Clausilia tridens, Chemn. Porto Rico. Mr. Robert Swift.

Jaw (Pl. XV, fig. J) slightly arcuate, smooth, wide, low; ends slightly attenuated, blunt; cutting edge with a blunt, wide, median projection. In the jaw figured, the lower margin is developed, but much thinner, beyond the cutting edge.

Lingual membrane (Pl. VII, fig. H) short and broad, with about 30-1-30 teeth. Centrals with long, narrow base of attachment, incurved at the sides and base, where it is also excavated or thinned, rounded at top, and reflected; reflection small, with one large cusp bearing a short, blunt, cutting point, and sub-obsolete side cusps; laterals like centrals, but asymmetrical, the base of attachment much wider, the reflection and cusp with its cutting point much stouter and longer; outer laterals with distinct side cusp and cutting point; the base of attachment of the laterals is squarely cut away on its inner angle; about the eleventh tooth the teeth begin to change to marginals; the extremes of which last are subquadrate, wider than high, broadly reflected into a large cusp bearing two oblique, large, irregularly bifid cutting points.

The figures of the jaw and lingual dentition of this species were photographed from the microscope by my friend, Mr. Samuel Powel, of Newport, to whom I am greatly indebted for assistance in my studies of lingual dentition.

Stenogyra.

See Terr. Moll., V, for dentition of *S. subula*, Pfr., and *decollata*, Lin.

Stenogyra gonostoma, Gundl. Cuba. D. Rafael Arango.

Lingual membrane as in next species.

Stenogyra octona, Chemn. Bahia. J. G. Anthony.

Lingual membrane short and broad.

Teeth about 30-1-30. Centrals with base of attachment long, narrow, angularly expanded at centre; reflection small, bluntly tricuspid, the central cusp bearing a short, stout, cutting point; laterals much larger, as wide as long; reflection very large, with an inner median large, and a small outer cusp on each side of it, all the cusps bearing distinct cutting points; marginal teeth low, wide, irregularly denticulated by minute cutting points. The peculiarity of the dentition, as in the other species of *Stenogyra*, is the small central as well as distinctly tricuspid laterals; the latter are not crowded on the membrane.

Stenogyra hasta, Pfr. Cuba.

Jaw (Pl. XV, fig. I) low, arcuate, ends somewhat attenuated, blunt; no median projection to cutting margin; anterior surface with numerous, vertical, delicate, striæ.

Lingual membrane (Pl. VII, fig. D). Teeth 18-1-18, as usual in the genus. (See Terr. Moll., V.)

Stenogyra juncea, Gld. Island of Huahine. Mr. A. Garrett. Described by Gould and Pfeiffer as a *Bulinus*.

Lingual membrane with 28-1-28 teeth, eight of which on each side are laterals; dentition as in *S. hasta*.

Strophia.

See Terr. Moll., V, for jaw and lingual dentition of *S. incana*.

Strophia decumana, Fér. Castle Island, Bahamas.

Jaw stout, strongly arcuate, ends slightly attenuated, bluntly rounded; anterior surface ribless, transversely striate, and with several stout lines of reinforcement; a small, blunt, median projection to the cutting edge.

Lingual membrane (Pl. VII, fig. A) with 30 1-30 teeth; centrals short, about as broad as long, with short, stout median cusps to the reflection, bearing a stout, broad cutting point, and subobsolete side cusps bearing

short cutting points; laterals like the centrals, but bicuspid and asymmetrical; the outer laterals have the inner cutting point bluntly bifid; marginals a modification of the laterals, low, wide, with one inner, large, blunt, bifid cutting point, and one outer smaller.

Strophia mumia, Brug. Abaco, Bahamas.

Jaw slightly arcuate, stout, rough, rather high, ends but little attenuated, blunt; cutting edge with a wide, blunt, slightly developed median projection.

Lingual membrane (Pl. VII, fig. B) with about 30-1-30 teeth, as in the last species. There is a line of reinforcement to the lower margin of the base of attachment of the central and lateral teeth.

Strophia iostoma, Pfr.

Jaw as in other species of the genus.

Lingual membrane (Pl. VII, fig. C) not differing from that of the allied species. Teeth about 29-1-29.

Cionella.

Cionella Gloynei, Gibbons. Curaçao. Mr. J. S. Gibbons.

Jaw and lingual membrane, as usual in *Stenogyra*.

Pl. VII, fig. E, represents the central and first lateral teeth.

Cæcilianella.

Cæcilianella Gundlachi, Pfr. St. Martin. Dr. H. E. Rygersma.

Jaw low, (Pl. XVI, figs. F, G,) wide, slightly arcuate, ends attenuated; whole surface covered with about 22 crowded, broad, flat ribs, denticulating either margin.

Lingual membrane (Pl. VII, fig. F) long and narrow. Teeth 18-1-18, with four perfect laterals. Centrals with their base of attachment long, narrow, their reflected portion about one-half the length of the base of attachment, tricuspid; the middle cusp stout, with a short blunt cutting point, side cusps subobsolete, but with small, distinct cutting points. Lateral teeth with their base of attachment subquadrate, much longer, and very much broader than that of the centrals, the reflected portion short, stout, tricuspid, the middle cusp very stout and long, reaching the lower edge of the base of attachment, beyond which projects the short, stout cutting point; side cusps subobsolete, but bearing distinct, though small cutting points. There are four perfect laterals, the fifth tooth being a transition to the marginals, by the base of attachment being lower, wider, not exceeding the reflected portion, with one inner large cusp bearing one outer large cutting point representing the outer cutting point of the first four lateral teeth and one inner, still larger, cutting point, representing the middle cutting

point of the first four laterals, and one smaller, outer cusp, bearing one small, sharp, bifid cutting point, representing the outer side cutting point of the first four laterals. The sixth tooth has the largest cutting point bifid. The balance of the teeth are true marginals. They are very low, wide, with two low, wide cusps, bearing each several irregular, blunt, cutting points.

The dentition of this species is, as would be anticipated, of the same type as the allied *Coccilianella acicula*, as figured by Lehmann (Lebenden Schnecken Stettins, p. 128, Pl. XIII, fig. 43,) and Sordelli, l. c., fig. 26). The jaw, however, has no appearance of the "brace" like ribs described in that species by Sordelli (Atti Soc. Ital. Sc. Nat., XIII, 1870, 49, Pl. I, fig. 25). The ribs are quite like those figured of *Helix Lamsingi* (Terr. Moll., V), although they are narrower.

Lithotis.

Lithotis rupicola, Blandf. Bombay.

Referred by Pfeiffer to *Succinea*, but widely differing from that genus in not having an elasmognathous jaw.

Jaw (Pl. XVI, fig. C) arcuate, with a depression or excavation in the centre of its upper margin; scarcely attenuated towards the ends; cutting edge with a decided median projection; anterior surface with vertical striæ, but no trace of ribs.

Lingual membrane (Pl. VII, fig. G): centrals with long and narrow base of attachment; the reflected portion has one long, median cusp, bearing a long cutting point; laterals like the centrals, but asymmetrical; the outer laterals have a bifid side cutting point; marginals a simple modification of outer laterals.

Limicolaria.

Limicolaria Numidica, Rve.

Jaw thin, highly arcuate, smooth, ends attenuated.

Lingual membrane not examined.

(b) JAW WITH DECIDED STOUT RIBS.

This section, also, is unsatisfactory, as the species included in it are not all so characterized.

Anadenus.

Anadenus ———? Himalaya Mountains. An undetermined species.

The jaw is thick, low, wide, slightly arcuate; ends but little attenuated; anterior surface with fourteen stout, unequal, separated ribs, denticulating either margin.

On Pl. VII, fig. I, I have figured the lingual dentition of this slug, whose specific name is unknown to me. There are 58-1-58 teeth.

The dentition is of the same type as described in the genus by Heyne-mann, Malak. Blatt., X, 1863, p. 138.

Carelia.

Carelia bicolor, Jay. Dr. W. H. Dall.

Through the kindness of Dr. Dall, I have been able to examine this species, formerly known as *Achatina bicolor*. Thus I have increased the list of subgenera or groups of *Achatinella* of Gulick's arrangement, whose jaw and lingual dentition is known, leaving still to be examined *Newcombia* only of the same arrangement. (See *ante*, p. 96.)

It will be seen from my description, that while *Carelia* (or at least this species) differs utterly in jaw and dentition from Gulick's *Achatinella*, s. s., *Bulinella*, *Apex*, *Partulina*, *Auriculella*, it agrees in dentition with his *Laminella*, *Amastrea*, *Leptachatina*, but differs in having a costate jaw. *Carelia*, therefore, must stand distinct from any other groups of *Achatinella*.

The jaw (Pl. XVI, fig. D) is low, slightly arcuate, with but little attenuated, blunt ends; anterior surface with ten stout ribs, denticulating either margin.

Lingual membrane (Pl. VI, fig. I) long and narrow; teeth 37-1-37, of same type as in the species of *Laminella*, *Newcombia*, and *Leptachatina* (see above), the marginals being irregularly and obliquely pectinate as in *Achatinella obesa*.

Geomalacus.

Geomalacus maculosus, Allm. Ireland. Mr. Gwynn Jeffreys.

Jaw stout, arched, ends not attenuated, blunt; anterior surface with about twelve, broad, crowded ribs, of which four in the centre are more developed and deeply denticulate either margin.

Lingual membrane (Pl. III, fig. H) ; centrals with long and narrow base of attachment; reflection large, with a stout median cusp bearing a long, stout cutting point; side cusps obsolete; laterals like the centrals, but asymmetrical; marginals to the extreme edge of the membrane a simple modification of the laterals, low, wide, with one inner, long, oblique cutting point, and a smaller, side cutting point.

Veronicella.

See Terr. Moll., V, for a description of jaw and lingual membrane of the genus. The following species agree in lingual dentition :—

Veronicella occidentalis, Guild. Guadeloupe. Mr. Schramm.

Jaw with about 30 ribs.

Veronicella Sloanei. Jamaica.

Jaw with 20 broad ribs.

Veronicella ———. Rio Janeiro, Brazil. J. G. Anthony.

The species undetermined, Body very long and slender.

Jaw with about 30 ribs.

Lingual membrane figured on Pl. III, fig. B.

Veronicella ———. Rio Janeiro. J. G. Anthony.

The species undetermined.

Jaw with 20 broad ribs.

Veronicella ———. Costa Rica. Dr. W. M. Gabb.

An undetermined species. Body long and narrow.

Jaw with from 30 to 40 ribs.

Veronicella ———. Mozambique. Mr. J. S. Gibbons.

An undetermined species.

Jaw with over 22 ribs.

Veronicella olivacea, Stearns. Folvon, Occidental Department, Nicaragua. Mr. McNeil.

Jaw with over 20 ribs.

Lingual membrane, see Terr. Moll., V.

Simpulopsis.

Shuttleworth describes the jaw as having numerous, stout, anterior ribs.

Simpulopsis corrugatus, Guppy. Trinidad. Mr. Guppy.

Jaw not observed.

Lingual membrane (Pl. VII, fig. J) with teeth of same type as figured by Heynemann for *S. sulculosus*. Centrals smaller than the laterals; base of attachment almost as broad as long, its lower margin excavated as in *Succinea*; reflection large, with three cusps and cutting points. Laterals like the centrals, but larger and asymmetrical, the inner, larger cusp of the reflection bearing a very large, expanded, blunt cutting point.

Cryptostrakon.

Cryptostrakon Gabbi, W. G. Binn. Costa Rica. Dr. W. M. Gabb.

Jaw (Pl. XVI, fig. L) high, solid, decidedly arched, ends scarcely attenuated; anterior surface with a few stout ribs, denticulating the lower margin.

Lingual membrane (Pl. VII, fig. K) long and narrow; central teeth tricuspid; laterals bicuspid; marginals quadrate, irregularly bicuspid, the inner cutting points the larger and bifid.

Microphysa.

Microphysa is put in *Helicea* by von Martens. *M. minuscula* (Terr. Moll., V), and *circumfirmata*, Redf., both belong to *Vitrinea*, having aculeate marginal teeth, and jaw of *Zonites*. *M. turbiniformis*, Pfr., has a jaw as in *Cylindrella*, *Bulimulus*, etc., i. e., with numerous very delicate, distant ribs, giving the appearance of separate plates. It would be put in *Goniognatha* of Mörch, though there are no upper triangular median plates. *M. vortex* and *incrustedata* (see Terr. Moll., V) have quadrate marginal teeth; the jaw of *incrustedata* has numerous, crowded, flat ribs; that of *vortex* was not observed.

Microphysa? circumfirmata, Redfield.

Jaw not observed.

Lingual membrane long and broad, centrals tricuspid, laterals bicuspid, cusps long and slender, marginals aculeate.

From the above description it will appear that this species belongs to the *Vitrinea* rather than to the *Helicea* of von Marten's arrangement, in which latter it is classed in "Die Heliceen" as a species of the subgenus *Microphysa*. I leave it here, not knowing what else to do with it.

Microphysa turbiniformis, Pfr. Jamaica. Mr. Henry Vendreyes.

Jaw (Pl. XV, fig. C) so extremely thin and delicate as to fold over on itself along its margin and at its extremities; very light horn-colored, almost transparent; strongly arched, attenuated towards its obtuse ends; about forty delicate ribs, such as are found in *Cylindrella*, serrating either margin on about the centre of the jaw is a curving line of reinforcement, somewhat parallel to the lower margin; the upper margin slightly incurved at its centre; the ribs at the centre of the upper margin do not run *en chevron* as do those of *Cylindrella*.

Lingual membrane (Pl. VII, fig. L) long and narrow; teeth about 25-1-25. Centrals large in proportion to the laterals, with a subquadrate base of attachment; three decided, separated cusps and cutting points; laterals tricuspid; marginals low, wide, with both inner and outer cusp bearing an oblique, broad, bifid cutting point.

Fruticicola.

See Terr. Moll., V, for *F. rufescens* and *hispida*.

Fruticicola pubescens, Pfr. Haiti. Mr. V. P. Parkhurst.

Jaw (Pl. XV, fig. H) thin, semitransparent, low, slightly arcuate, ends scarcely attenuated, blunt; upper margin with a strong muscular attachment; no median projection to cutting edge; anterior surface with about twenty ribs denticulating either margin; these ribs appear in most cases to be broad, flat, with narrow interstices, but in others there are appearances such as I have described in *Bulimulus linnaeoides* (see below).

Lingual membrane long and narrow (Pl. VI, fig. J). Teeth as usual in the *Helicinae*. The change from laterals to marginals is very gradual, not formed by the splitting of the inner cutting point. The 12th tooth (figured) shows the commencement of the transition. The 22d (figured) is a marginal tooth. The inner cutting point of the marginals is rarely bifid. Teeth 24-1-24.

Dorcasia.

There is wide variation in the characters of the jaws in this genus. For *D. griseola*, Pfr., see Terr. Moll., V.

Dorcasia similis, Fér. Brazil. J. G. Anthony.

Jaw arched, ends not attenuated, blunt; anterior surface with eight separated ribs, denticulating either margin.

Lingual membrane (Pl. VI, fig. L) long, with unicuspid centrals and laterals; marginals low, wide, each cusp bifid.

Dorcasia globulus, Müll.

Jaw low, wide, scarcely arcuate, ends not acuminate; no anterior ribs.

Lingual membrane (Pl. VI, fig. M) with about 40-1-40 teeth; teeth with almost square bases of attachment; both centrals and laterals are very distinctly tricuspid; marginals a simple modification of laterals, the broad cutting point trifid.

Both by jaw and lingual dentition this does not agree with the other species of *Dorcasia* examined.

Turricula.

For *T. terrestris*, see Terr. Moll., V.

Turricula tuberculosa, Conr. Palestine. A dried specimen in Mr. Bland's collection.

Jaw with numerous, crowded, broad, flat ribs, denticulating either margin.

Lingual membrane (Pl. VI, fig. N) long and narrow. Teeth 28-1-28; centrals and laterals without decided side cusps or cutting points, but the central cutting point has a decided lateral bulge; marginals low, wide.

with one inner, oblique, large bifid cutting point, and two outer smaller cutting points. A marginal is shown in the figure, with a central and lateral.

Coryda.

Coryda Gossei, Pfr. Jamaica. Messrs. Vendreyes and Gloyne.

Jaw not examined.

Lingual membrane (Pl. V, fig. J) broad; of same type as in *Plagioptycha*.

Plebecula.

Plebecula lurida. Madeira. Dr. Hillebrand.

Jaw low, slightly arcuate, ends scarcely attenuated; anterior surface with about eight broad, separated ribs.

Lingual membrane (Pl. V, fig. K) with tricuspid centrals, bicuspid laterals, all the cusps bearing cutting points; marginals with one, inner, long, oblique, bifid cutting point, and one outer, smaller, bifid cutting point.

Leptaxis.

Leptaxis undata, Lowe. Madeira. Dr. Hillebrand.

Jaw described by Mörch as narrow, with numerous ribs converging to the centre.

Lingual membrane (Pl. VIII, fig. C) of the individual examined, peculiarly abnormal, the malformed teeth as figured being repeated frequently on each transverse row, and down the whole length of the membrane. Such malformations are often found in lingual membranes.

Pomatia.

See Terr. Moll., V, for description of jaw and membrane of *P. aspersa*.

Pomatia Sieboldtiana, Phil. Japan.

Jaw high, arched, ends but little attenuated, blunt; anterior surface with eight stout, separated ribs, denticulating either margin; no median projection to cutting edge. (Pl. XVI, fig. H.)

Lingual membrane (Pl. VIII, fig. B) long and narrow; teeth 39-1-39, with 21 perfect laterals on each side of the median line; base of attachment of centrals long and narrow, reflection broad, with stout median cusp and cutting point; side cusps and cutting points wanting; laterals like the centrals, but asymmetrical, the fifteenth lateral is the first with the side cutting point; marginals low, wide, with one broad, oblique, bluntly bifid cutting point, and one side, short, cutting point.

The species was put by von Martens in *Acusta*, a sub-genus of *Nanina*.

Pomatia Humboldtiana, Val. Mexico. Dr. E. Palmer.

Jaw short, arched, bluntly ending; with six broad, separated, stout ribs, denticulating either margin.

Lingual membrane (Pl. VIII, fig. A) with shorter, stouter teeth than in the last species. The centrals are pear-shaped, with no side cusps or cutting points.

Thelidomus.

Jaw with stout anterior ribs.

Lingual membrane the same in the species examined, in general characteristics, but there will be found variation as to the presence of side cutting points on centrals and laterals.

Thelidomus aspera, Fér. Jamaica. Mr. V. P. Parkhurst.

Jaw wide, low, arcuate, ends but slightly attenuated, blunt; anterior surface with eight sharp, prominent ribs, strongly denticulating either margin.

Lingual dentition (Pl. VIII, fig. E) long and narrow. Teeth 41-1-41. Centrals and laterals with stout broad cusps and cutting points; no side cusps or cutting points; marginals with one long, bluntly bifid cutting point.

Thelidomus discolor, Fér.

Jaw arcuate, thick, ends blunt. Anterior surface with seven unequal, decided, stout ribs, denticulating either margin.

Lingual membrane (Pl. VIII, fig. D) long and narrow. Centrals with a long narrow base of attachment expanded at the base, and bearing at its corners a small reinforcement; lower margin extending beyond the cusp; reflection bluntly tricuspid, the median cusp long, stout, with a short blunt point; side cusps subobsolete. Laterals as the centrals, but asymmetrical, and with a shorter base of attachment. Marginals quadrate, wide as high, with two short, blunt denticles, the inner one slightly the longer.

Thelidomus auricoma, Fér. Lomas de Camoa, Cuba. Mr. Arango.

Jaw arched, with blunt, scarcely attenuated ends; twelve broad ribs distributed over the whole anterior surface and denticulating either margin.

Lingual membrane (Pl. VIII, fig. F) with 42-1-42 teeth, of which 25 may be called laterals, but the change is gradual into marginals. Teeth as in *provisoria*.

Thelidomus notabilis, Shuttl. Tortola. Mr. Robert Swift.

Jaw arcuate, low, ends blunt, narrower at the centre; decided separate ribs denticulating either margin.

Lingual membrane (Pl. VIII, fig. G). Centrals tricuspid; laterals bicuspid; the base of attachment about as wide as high, the larger cusp with a long cutting point extending beyond the lower margin of the base of attachment.

Marginals quadrate, of equal width and height, with two short, wide, blunt, round cusps, the inner one slightly the larger.

Thelidomus lima, Fér. Porto Rico. Mr. R. Swift.

Jaw arcuate, ends blunt; anterior surface with seven stout ribs; a strong muscular attachment.

No lingual membrane examined.

Thelidomus Jamaicensis, Chemn. Jamaica. V. P. Parkhurst.

The species is placed in *Liochila* by von Martens, but Mr. Bland places it in this genus.

Jaw thick, arcuate, ends attenuated; anterior surface with 14 decided but unequal ribs, irregularly disposed and denticulating either margin.

Lingual membrane (Pl. VIII, fig. H) long and narrow, with 41-1-41 teeth; there are no distinct side cusps and cutting points on the centrals and inner laterals.

Thelidomus provisoria, Pfr. New Providence, Bahamas. Gov. Rawson.

Jaw very slightly arcuate, wide, low, of equal height throughout to its blunt ends; anterior surface with 10-15 ribs, separated by irregular intervals, not always reaching the cutting edge, which has a broad, blunt, median projection.

Lingual membrane (Pl. VIII, fig. I) with 40-1-40 teeth; the centrals and laterals have a distinct side cutting point.

Eurycratera.

Eurycratera angulata, Fér. Porto Rico. Mr. R. Swift.

Jaw stout, dark claret-colored, low, wide, ends blunt; about seven very wide, very crowded ribs, bluntly denticulating either margin.

Lingual membrane (Pl. VIII, fig. J); central and laterals with distinct side cutting points.

Eurycratera crispata, Fér. San Domingo. Dr. Newcomb.

Jaw thick, arcuate, ends blunt; anterior surface with ten stout ribs.

Lingual membrane (Pl. VIII, fig. K). Centrals and laterals with the upper margin of the base of attachment produced into angles as below, with distinct side cutting point; middle cutting point of centrals and inner cutting point of laterals greatly produced.

Polydontes.

No jaw of this genus examined.

Polydontes Luquillensis, Shuttl.

Lingual membrane (Pl. VIII, fig. L) as usual in the *Helicidae*. Centrals tricuspid, laterals bicuspid; cusps with long, sharp cutting points, extend-

ing beyond the base of attachment; marginals bicuspid, cusps short, bluntly rounded, the inner one, as usual, the longer, each bearing short cutting points.

Stylodon.

I have shown *H. militaris*, Pfr., placed in this genus by von Martens, to be a *Nanina*.

Stylodon Studeriana, Fér. Seychelles. Consul Pike.

Jaw stout, strongly arched, ends but little attenuated, blunt; anterior surface without ribs; there are, however, a few coarse, broad, vertical wrinkles. One jaw had a slightly developed median projection to its cutting edge, another has no approach to a projection.

Plate VIII, fig. M, shows the lingual dentition; teeth 69-1-69, with about 22 laterals on each side. There is considerable resemblance to the dentition of *Merope fringilla* described below. The cutting points on centrals and laterals are, however, more pointed. There are no side cusps or cutting points to centrals or inner laterals; the outer laterals and marginals have very oblique, broad, bluntly trifid cutting points.

Dentellaria.

In this genus, the presence or absence of ribs on the jaw is not a reliable generic character.

I have examined a large proportion of the known species. The jaw varies somewhat, so that each description should be studied. There seems a tendency to a median projection to the cutting edge, and to the presence of ribs. *D. pachygastra*, Gray, has seven decided ribs and no median projection; *orbiculata*, Fér., has traces of ribs and no median projection; *Isabella*, Fér., has decided ribs and no median projection; *dentiens*, Fér., has decided ribs and no median projection; *nucleola*, Rang., has one decided rib and a median projection; *badia* has eight decided ribs; *formosa*, Fér., has no ribs, but a strong median projection; *perplexa*, Fér., has obsolete ribs and median projection; *lychnuchus*, same as last; *punctata*, Born, has median projection and decided ribs; *Josephinae*, Fér., is strongly arched, has no ribs, but a median projection.

The species agree in their dentition.

Dentellaria orbiculata, Fér.

Jaw striated, thick, slightly arched, ends squarely truncated; cutting edge irregular, showing traces of the ends of subobsolete ribs, no median projection. (Pl. XVI, fig. W.)

Lingual membrane (Pl. IX, fig. A) long and broad, with 47-1-47 teeth. Base of attachment long and narrow in centrals, a line of reinforcement near its upper margin; reflected portion small, stout, with a short, stout median cusp bearing a short, stout cutting point, no side cusps or cutting points; first laterals like the centrals, but asymmetrical; outer laterals with side cusp and cutting point; marginals low, wide, with one large, inner bluntly bifid cutting point and one outer small bifid cutting point.

Dentellaria Isabellæ, Fér. Barbadoes. Gov. Rawson.

Jaw striated vertically and horizontally, with about eight well-defined ribs denticulating either margin.

Lingual membrane (Pl. IX, fig. B) as above.

Dentellaria dentiens, Fér. Dominica. Mr. Guppy.

Pl. IX, fig. C, gives full details of the changes of the teeth from centrals to marginals, especially the side cusp and cutting point of the outer laterals, and the transition from laterals to marginals; teeth 33-1-33.

Jaw (Pl. XVI, fig. N) with 4-5 stout ribs denticulating either margin.

Dentellaria nucleola, Rang. Martinique. Gov. Rawson.

Jaw thick, arched, ends blunt; cutting margin with an obtuse median projection; one central, stout rib, denticulating either margin. (Pl. XVI, fig. O.)

Lingual membrane as usual in *orbiculata*. (Pl. IX, fig. D.)

Dentellaria nuxdenticulata, Chemn. Martinique. Gov. Rawson.

Jaw (Pl. XVI, fig. V) stout, arched, ends blunt; blunt median projection to cutting edge; one stout, well-developed rib on the centre of the jaw, and three less developed, separated, on either side of it.

Lingual membrane (Pl. IX, fig. E) as in the other species.

Dentellaria pachygastra, Gray. Guadeloupe. Mr. Schramm.

Jaw (Pl. XVI, fig. P) stout, slightly arcuate, ends blunt; anterior surface with about seven irregularly disposed ribs; both ends free from ribs.

Lingual membrane (Pl. IX, fig. F) as in the other species.

Dentellaria badia, Fér.

Jaw stout, arched, ends blunt; eight decided ribs. (Pl. XVI, fig. Q.)

Lingual membrane (Pl. IX, fig. G) as in other species.

Dentellaria formosa, Fér. Antigua. Mr. Robert Swift.

Jaw arched; ends blunt; several strong, transverse lines of reinforcement, but no ribs; a median projection to cutting edge. (Pl. XVI, fig. R.)

Lingual membrane as usual in the genus. (Pl. IX, fig. H.)

Dentellaria Josephinæ, Fér. Guadeloupe. Mr. Schramm.

Jaw (Pl. XVI, fig. S) stout, ribless, horseshoe-shaped, ends bluntly

rounded; a decided median projection to the cutting edge, marked with strong vertical striæ.

Lingual membrane as in other species. (Pl. IX, fig. I.)

Dentellaria perplexa, Fér. Island of Grenada. Gov. Rawson.

Jaw with a median projection to its cutting edge, The anterior surface is of irregular thickness, showing some approach to the ribbed form of jaw. (Pl. XVI, fig. T.)

Lingual membrane as usual. Central and lateral teeth with short, stout, blunt cusps. Marginal teeth quadrate, with one wide, stout, bluntly rounded median cusp, and two small, blunt side cusps. (Pl. IX, fig. J.)

Dentellaria lychnuchus, Müll. Guadeloupe. Mr. A. Schramm.

Jaw (Pl. XVI, fig. U) arched, ends blunt, cutting margin with a broad, blunt, median projection; strong vertical striæ and transverse lines of reinforcement, and subobsolete ribs, which denticulate the upper margin.

Lingual membrane as in the other species. (Pl. IX, fig. K.)

Pleurodonta.

The jaw is decidedly costate. Lingual membrane much as in *Plagioptycha* and *Dentellaria*.

Pleurodonta acuta, Lam. Jamaica.

Jaw arched, thick, ends blunt, attenuated; anterior surface with seven distant, stout ribs, denticulating either margin.

Lingual membrane (Pl. X, fig. A) with 40-1-40 teeth as above; the marginal figured has only one long, oblique cutting point.

Pleurodonta Chemnitziana, Pfr. Jamaica. Mr. Robert Swift.

Jaw stout, arched, ends attenuated, blunt; anterior surface with about six irregularly disposed ribs, stout and denticulating either margin.

No lingual membrane received.

Pleurodonta Carmelita, Fér. Jamaica. Mr. Robert Swift.

Jaw arcuate, ends blunt, anterior surface with about six stout ribs, denticulating either margin.

Lingual membrane (Pl. X, fig. B) as usual in the genus. Central teeth short, bluntly pointed on the middle cusps, the side cusps subobsolete; laterals like centrals, also with obsolete side cusps and cutting points; marginals low, wide, with an inner large, oblique, bluntly trifid cutting point.

Pleurodonta Schroeteriana, Pfr. Jamaica. Mr. Vendreyes.

Jaw not examined.

Lingual membrane (Pl. X, fig. C) as in other species.

Pleurodonta invalida, Ad. Jamaica. Mr. Henry Vendreyes.

Jaw not examined.

Lingual membrane (Pl. X, fig. D) as in the other species. Centrals and laterals short and stout.

Merope.

Merope fringilla, Pfr. Admiralty Island. Prof. A. G. Wetherby.

The dried remains of the animal in the shell of a cabinet specimen furnished the lingual membrane and jaw here described. The shell is the variety with the pink peristome.

Jaw with numerous crowded, stout ribs, denticulating either margin.

Lingual membrane (Pl. X, fig. E) long and narrow; teeth 28-1-28, with about 11 laterals. Centrals with base of attachment longer than wide; side cusps obsolete, side cutting points wanting; middle cusp broad, blunt, with a very short, broad, blunt cutting point. Laterals like the centrals, but asymmetrical; the cutting point becomes longer as they pass off laterally, and at the 12th tooth it commences to be bluntly trifid. The marginals are peculiar; their base of attachment is subquadrate, with a single broad cusp, bearing a very broad, oblique, expanding, trifid cutting point; the outer division very small, pointed; the median longer, very broad, squarely truncated; the inner one about half the size of the median, recurved and sharply pointed.

The left hand figure in the plate shows a marginal in profile.

The dentition of this species is peculiar, resembling that common in *Orthalicus* rather than the type usual in *Helix*.

Helix, ———. Costa Rica. Dr. W. M. Gabb.

Jaw not observed.

Lingual membrane (Pl. V, fig. L) long and narrow. Teeth 15-1-15. Centrals with a base of attachment longer than wide, with lower lateral expansions; reflection large, decidedly tricuspid, each cusp surmounted by a cutting point. Laterals like the centrals, but asymmetrical and consequently bicuspid. Marginals low, wide, irregularly denticulated or serrate, the inner three cutting points being longer than the outer ones, of which there are several.

Helix astur, Souv. I do not know the position of this species. New Caledonia.

Jaw (Pl. XVI, fig. B) low, wide, slightly arcuate, ends scarcely attenuated, blunt; anterior surface without ribs; a wide, blunt, median projection to the cutting edge; a line of reinforcement running parallel to the cutting margin; a strong muscular attachment to the upper margin.

Lingual membrane (Pl. X, fig. F) with 30-1-30 teeth, nine perfect laterals on each side; teeth as usual in the *Helicidae*; with decided side cusps and cutting points.

Helix convicta, Cox. Australia. Dr. Cox.

Subgeneric position unknown to me.

Jaw highly arcuate, thick, ends blunt; anterior surface with seven separated, stout ribs, denticulating either margin.

Lingual membrane (Pl. X, fig. G) with 30-1-30 teeth, ten laterals on each side; centrals and inner laterals without side cutting points; marginals low, wide, with one inner, large, oblique bifid cutting point, and one smaller side cutting point.

Cochlostyla.

The only subgenus examined is *Canistrum*, and this only in one species:—

Canistrum fulgetrum, Brod.

Jaw arcuate, thick, wide, low, ends but slightly attenuated, blunt; anterior surface with more than twelve stout, broad ribs, denticulating either margin.

Lingual membrane (Pl. XI, fig. G) long and broad, with 80-1-80 teeth; centrals and inner laterals without side cusps and cutting points, the reflection and cusp stout, the cutting point blunt; marginals with greatly produced, bluntly pointed upper margin to the base of attachment.

Bulimus.

Of this genus species of several subgenera were examined.

Macrodonates odontostomus, Sowb.

Jaw wide, low, slightly arched, smooth.

Lingual dentition (Pl. X, fig. H). Teeth 34-1-34; the cusps and cutting points are short and stout; no side cusps or cutting points.

Pelecychilus auris-Sileni, Born. St. Vincent.

Jaw with delicate, distant ribs, as in *Cylindrella*, q. v.

The cutting points on the teeth of the lingual membrane are very long. (Pl. X, fig. I). The upper, as well as lower, lateral angles of the base of attachment in the centrals and laterals are greatly developed.

Pelecychilus glaber, Gmel. Island of Grenada, W. I.

Jaw as in last species.

Lingual membrane (Pl. X, fig. J) with decided side cusps and cutting points to all the teeth.

Anthinus multicolor, Rang.

Jaw thick, greatly arched, ends attenuated, striate; no anterior ribs; no median projection to cutting edge.

Lingual membrane (Pl. XI, fig. A) with 40-1-40 teeth; base of attachment very long, reflection small, with a short blunt cutting point; no side cusps or cutting points.

Pachyotus egregius, Jay. Brazil. J. G. Anthony.

Jaw not examined.

Lingual membrane (Pl. XI, fig. B); the upper margin of the base of at-

tachment is carried beyond the reflection in the centrals; teeth stout, with stout cusps and cutting points.

Borus oblongus, var. *albus*, Müll. Tobago. Gov. Rawson.

Jaw slightly arcuate, stout, wide, of almost equal height throughout; ends but slightly attenuated, blunt; anterior surface with vertical and transverse striæ and perpendicular wrinkles, scarcely distinguishable from the ribs, of which there are ten well-developed, crenulating either margin.

Lingual dentition as published by Heynemann for *B. oblongus* in Mal. Blatt., 1868.

Orphnus Hanleyi, Pfr. Brazil. J. G. Anthony.

Jaw stout, strongly arched, transversely striate; ends but little attenuated, blunt; cutting edge with a broad, stout, striated median projection.

Lingual membrane (Pl. XI, fig. D) long and narrow; teeth 50-1-50; the lower margin of the base of attachment is excavated in centrals and laterals; no side cusps or cutting points.

Orphnus foveolatus, Rve. Northern Peru. Prof. Orton.

Jaw slightly arched, wide, low, thin, with over 50 delicate ribs of the kind described below under *Bulinulus Lobbi*, Rve.

Lingual membrane (Pl. XI, fig. C) long and narrow, with 34-1-34 teeth; no side cusps or cutting points to centrals and laterals; reflection short, stout; the membrane is of the same width to its abruptly truncated ends, and very thick.

Orphnus magnificus, Grat. Brazil.

Jaw stout, low, wide, slightly arched, ends slightly attenuated, blunt; entire anterior surface covered with numerous stout ribs, breaking the regularity of both upper and lower margin, but not actually denticulating them.

Lingual membrane long, rather broad, with 30-1-30 teeth. Teeth as in *O. Hanleyi*.

Dryptus pardalis, Fér.

Jaw thick, low, wide, slightly arcuate, ends but slightly attenuated, blunt; whole anterior surface occupied by 12 broad ribs, denticulating either margin.

Lingual membrane not examined.

Dryptus marmoratus, Dünker.

Lingual membrane (Pl. XI, fig. E) long and broad; no side cusps or cutting points.

Eurytus aulacostylus, Pfr. St. Vincent. Gov. Rawson.

Jaw thin, transparent, slightly arcuate, with about sixty delicate ribs, as

found in *Cylindrella*; no upper median ribs *en chevron*, but all the ribs slightly oblique.

Lingual membrane (Pl. XI, fig. F); centrals tricuspid, laterals bicuspid, each cusp with long cutting point.

(c) JAW WITH SEPARATE, DELICATE RIBS, USUALLY RUNNING
OBLIQUELY TOWARDS THE CENTRE.

Several species are found in the last genus with this type of jaw.

Gæotis.

The genus *Gæotis* was described by Shuttleworth,* founded on a curious mollusk from Porto Rico. The lingual dentition was said by him to be nearly the same as in *Vitrina* and *Zonites*, the teeth arranged in oblique rows, centrals obtusely tridentate, laterals scarcely differing from the centrals, marginals lengthened, awl-shaped, arcuate, at base ? bifurcate. The presence of a jaw was not verified by Shuttleworth. The character of the dentition was considered such as to denote carnivorous habits of the animal.

An examination of an unidentified Porto Rico specimen (Mr. R. Swift) has furnished the following description.

Gæotis ———.

Jaw (Pl. XV, fig. A) long, low, slightly arcuate, ends attenuated, extremely thin and delicate, transparent; in one single piece, but divided by over forty† delicate ribs into as many plate-like compartments of the type common in *Cylindrella* and *Butimulus*, but with no upper median triangular space; the ends of the ribs serrate the upper and lower margins.

Lingual membrane (Pl. XI, figs. H, I) long and broad, composed of numerous rows of teeth arranged *en chevron*. Centrals with base of attachment very long, narrow, obtuse above, incurved at sides, obtusely rounded and expanded at base, near which is a short, gouge-shaped, expanded cusp, whose lower edge has three bluntly-rounded cutting points. Laterals same as centrals in shape, but a little larger, and asymmetrical from the disproportionate expansion of the cutting point. Marginals same as laterals, but more slender, with more developed and graceful cutting points, of

* Férussac's figure of *Parmacella palliolum* seems to show a jaw with stout ribs; I do not think *Gæotis* can belong to the same genus, *Peltella*.

† Fragments only of the jaw were saved; the largest one I have figured, and from it estimate the whole number of ribs.

which the median is pointed, often bifid. There is much variety in the shape and denticulation of the cusps. The middle denticle is always the smallest. Teeth aculeate when seen in profile.

By its jaw, *Gæotis* calls to our mind the genera *Amphibulima*, and many species of *Bulimulus* and *Cylindrella*. There is some resemblance in its lingual dentition to the marginal teeth of *Orthalicus* and *Liguus*, as well as of *Polymita muscarum*. It also forcibly reminds one of some of the features of the dentition of *Triboniophorus*.

Amphibulima.

Amphibulima patula, Brug. Dominica. St. Kitts.

Jaw (Pl. XV, fig. E) slightly arcuate, low, ends attenuated; extremely thin and transparent, with prominent transverse striæ, divided longitudinally by about forty-five delicate ribs into so many plate-like sections of the same character as those of *Cylindrella*, *Macroceramus*, and many species of *Bulimulus*. No upper triangular median plates as in *Cylindrella*. Margin serrated by extremities of ribs.

Lingual membrane (Pl. XIII, figs. C, D) from a specimen from Dominica, long and broad, composed of numerous horizontally-waving rows of teeth, of the form usual in the *Helicidæ*. Centrals with subquadrate base of attachment extended at basal angles, narrowing towards the centre, expanding towards the upper edge, which is reflected and tricuspid, extending quite to the base of the tooth; the cusps are stout, the median one bluntly pointed, each bearing a cutting point. The lateral teeth are of the same type as the centrals, but asymmetrical. The marginals are long and narrow, rounded at base, narrowed at apex, reflected and bicuspid; cusps short, stout, bearing a cutting point, and generally a simple modification of those of the laterals. The extreme marginals have irregular cutting points, like simple papillæ. Fig. D shows a group of laterals. Fig. C shows the changes from centrals to extreme marginals.

Pl. XIII, fig. A, shows the dentition of the St. Kitts form, fig. B giving a group of laterals.

Lately the question of identity of these shells with the Guadeloupe *patula* has been raised (see Journal de Conchyliologie, XXI, 12). I have, therefore, again carefully examined the lingual membranes previously described, to learn if they give any difference worthy to be considered of specific value. I have figured teeth from each lingual membrane. I regret not having had the opportunity of examining Guadeloupe specimens also, but have never been able to receive the latter with the animal; indeed it seems

to be now found subfossil only.* I can only treat the question of the identity of the St. Kitts and Dominica forms, not their identity with Guadeloupe forms.

It will be seen that the Dominica form has sharper cutting points to the large cusps of its central and lateral teeth than that of St. Kitts. Fig. B shows a group of laterals of the former, in which some variation from the pointed shape is indeed shown, but no decided tendency that way. On the other hand, the laterals, from the St. Kitts form, show great constancy in the square truncation of the cutting points. (Fig. B.)

The teeth of the St. Kitts form are broader in proportion to their length than those of Dominica, have a greater curve in their outlines, and more developed side cusps, which overlap the median cusps.

The Dominica lingual in the only row counted had 87-1-87 teeth. A row of the St. Kitts form had 57-1-57. The marginal teeth of the St. Kitts form show a greater tendency to splitting into sharp denticles on the cutting cusps than those of Dominica.

It cannot be denied that certain variations may be noticed in the two lingual membranes. I believe, however, that these differences are not such as suggest specific distinction, especially as the shell furnishes no grounds for doubting the specific identity of the forms.

Mr. Bland has given a detailed account of the species in *Journal de Conchyliologie*, XXI, 342, October, 1873.

Amphibulima Rawsonis, Bl. Isle of Montserrat, between Nevis and Guadeloupe. Gov. Rawson.

Jaw as in *A. rubescens*, about 33 ribs; those at the upper centre running obliquely and meeting or ending before reaching the lower margin.

Lingual membrane (Pl. XIII, figs. H, G) as usual in the genus. Centrals with the base of attachment very much larger than that of the laterals, and with an enormous, single, broad, long, rapidly and obtusely pointed cutting point. No side cusps or side cutting points. Laterals of the form usual in the *Helicinæ*, with a stout, inner cusp, bearing a broadly truncated, short cutting point, and a small side cusp bearing a short cutting point.

The change from laterals to marginals is shown in the 10th, 15th and 27th teeth in the plate.

The marginals (28th and 68th teeth in the plate) have a long, narrow base of attachment, which near its lower margin bears a short, slightly expanding, bluntly trifid cusp; from this cusp springs a short, expanding, bluntly denticulated, broad, cutting edge, the inner denticle the largest. This cutting edge is shown in the 67th and 68th teeth on a more enlarged scale. There is great variation in the denticulation of the cutting edge. There are 68-1-68 teeth.

* See, also, under *A. Rawsonis*, for Fischer's description of the dentition of the Guadeloupe form.

The peculiarity of this membrane is the enormous development of the central tooth.

Fig. G shows a lateral in profile: I have given figures of the dentition of *A. patula*, Brug., of St. Kitts and of Dominica, of *A. appendiculata*, Pfr., of Guadeloupe, and of *A. rubescens*, Fér., of Martinique. Dr. Fischer (Journ. de Conch., XXII, 1874, Pl. V) figures that of *A. depressa* of Guadeloupe, and *A. patula* of Guadeloupe.

Dr. Fischer also (l. c.) figures the dentition of *A. rubescens*. He gives inner side cutting points to the lateral teeth, which I did not find in my specimens. His figure of the dentition of the Guadeloupe *A. patula* is certainly specifically distinct from the St. Kitts and Dominica form. It seems as if there were the following distinct species of *Amphibulima*: *depressa*, *appendiculata*, *rubescens*, *patula* of Guadeloupe, *patula* of St. Kitts and Dominica, and *Rawsonis*.

Amphibulima rubescens, Desh. Martinique. Gov. Rawson.

The jaw is readily detached from the muscles of the mouth, and is not connected with the lingual membrane as usual with our *Helices*.* It is thin, wide, low, arched, with attenuated, bluntly pointed ends, divided by numerous (about 63) delicate ribs into separate plate-like divisions, as in the jaw of *Cylindrella*, *Bulimulus*, etc., the ribs running somewhat obliquely towards the centre of the jaw; there is no decided, upper median, triangular plate. (Pl. XV, fig. D.) The lingual membrane (Pl. XIII, fig. F) is long, broad, composed of numerous rows of 76-1-76 teeth. Centrals long, narrow, expanding below, with the lower margin of the base of attachment squarely excavated as in *Succinea*; tricuspid, the central cusp very long, wide, with a greatly expanded, squarely truncated cutting point reaching beyond the lower margin of the base of attachment; the side cusps short and narrow, simply pointed. The lateral teeth are of same type as the centrals, but asymmetrical and bicuspid. The marginals are a simple modification of the laterals, with a long, bluntly truncated median cusp, and obsolete side cusps. The extreme marginals are irregularly denticulated, the outer and inner denticles being more produced, especially the outer, and greatly curved; the inner denticles, usually two in number, are quite small.

Amphibulima appendiculata, Pfr. Guadeloupe. Gov. Rawson.

Jaw (Pl. XV, fig. F) extremely thin and transparent, long, low, slightly arcuate, ends blunt, divided longitudinally by about 40 regular ribs into as many

* Even after boiling the whole buccal mass in potash, the lingual membrane and jaw remain attached in most of our *Helices* of N. A. showing a decided connection between the two.

See last species for remarks on Dr. Fischer's description and figure of the dentition of the species.

plate-like sections, of the character found in the jaws of *Cylindrella*, *Macroceramus*, and many species of *Bulimulus*. No appearance of triangular upper median plates, however, as in *Cylindrella*, though the two specimens examined by me are not perfect at that part. Both margins serrated by the extremities of the ribs. The jaw is quite membranous.

Lingual membrane (Pl. XIII, fig. E). Centrals subquadrate with a very large, stout, short, pointed cusp, the side cusps obsolete. Laterals larger and more narrow than the centrals, bicuspid, the inner cusp greatly produced, broad and quite squarely terminating. The base of attachment of the laterals is cut away on the inner side, leaving a large outer lateral expansion, bringing to mind the much less developed one of *Succinea*. Marginal teeth quadrate, gradually becoming modified from the laterals, the cusps finally passing off into simple, obtuse papillæ, the inner one the larger.

Bulimulus.

The species of this genus may be grouped by their lingual dentition, independently of the character of the shell, into (a) those having the type of teeth usual in the *Helicidæ*, and (b) those having the peculiar type of dentition figured on Pl. XII, fig. G (see *B. primularis*), and (c) those having the dentition of *B. Lobbi*. (Pl. XIV, fig. E.) The former two types are found in several of the subgenera noticed below.

The jaw of *Bulimulus* is usually thin, with delicate, separated ribs as in *Cylindrella*, their ends serrating either margin; the ribs at the upper centre of the jaw often run obliquely and terminate before reaching the lower margin.

Drymæus altoperuvianus, Rve. Between Balsas and Cuzamarca, Peru. Prof. Orton.

Jaw with 31 ribs, delicate, separated, as in *Cylindrella*.

Lingual membrane (Pl. XIV, fig. F) very peculiar, resembling that of *B. Lobbi*, described below, excepting that the marginal teeth are of same type as the laterals, with still more produced cutting point; one in profile is shown in the left-hand figure.

Drymæus Vincentinus, Pfr., var.? Tobago.

Jaw as usual in *Bulimulus*, thin, transparent, with numerous delicate, separated, narrow ribs.

Lingual membrane as in *Bulimulus laticinctus*. (See below.)

Drymæus Knorri, Pfr. Porto Cabello, Venezuela. Mr. Robert Swift.

Jaw arched, high, ends attenuated, blunt; an obtuse median projection to cutting edge; transverse lines of reinforcement, but no ribs.

An unusual form of jaw in this genus, though common in many subgenera of *Helix*.

Drymæus Lobbi, Rve. Between Balsas and Cajamarca, Peru.
Prof. Orton.

Jaw (Pl. XV, fig. P) thin, transparent, as usual in the genus, with 21 narrow, distant ribs, serrating either margin, running obliquely towards the centre of the jaw, so that those of the upper centre meet or end before reaching the lower margin; the substance of the jaw is so thin that it divides, on maceration, into separate pieces at the ribs; in some specimens the jaw seemed to be formed of distinct plates, whose overlapping forms the ribs; I have no doubt, however, that it consists of one single piece.

Lingual membrane (Pl. XIV, fig. E) broad, very delicate in texture, and difficult to handle; numerous rows of 90-1-90 teeth; the centrals have the base of attachment longer than wide, with lower lateral expanded angles; the reflection has one stout, median cusp, the side cusps being obsolete; this cusp bears a short, rapidly attenuated, sharp cutting point; the laterals are of same type as centrals, but differ widely in the cutting point, which is oblique, extremely long, broad as the upper margin of the base of attachment, bluntly rounded at its end, near which on the inner side is a prominent, blunt notch; the marginals are low, wide, with a very oblique cusp, bearing a much broader, trifid cutting point, the middle one much the largest, all with curving sides.

Drymæus Bahamensis, Pfr. New Providence, Bahamas.
Gov. Rawson.

Jaw as usual in the genus, over fifty ribs; in some specimens the ribs at the centre meet or end before reaching the lower margin, so oblique are they; in others they are so slightly oblique as to reach and serrate the lower margin.

Lingual membrane (pl. XII, fig. F) with no lateral teeth, all the side teeth being marginals of the form described in *B. Lobbi*.

Drymæus Rawsonis, H. Ad. Tobago. Gov. Rawson.

Lingual membrane as in last species.

Liostracus multifasciatus, Lam. Antigua. Gov. Rawson.

Jaw as usual in the genus.

Lingual membrane as in last species; the cusp of the central tooth has three cutting points. The marginals are in waving rows.

Liostracus alternans, Beck. Islands in the Bay of Panama.
Mr. McNeil.

Jaw as usual in the genus, 52 ribs.

Lingual membrane as in last species.

Liostracus Marielinus, Poey.

See Terr. Moll., V.

Mesembrinus primularis, Rve. Northern Peru. Prof. Orton.

Jaw as usual in the genus.

Lingual membrane (Pl. XII, fig. G) as in last species, but there is only one cutting point in the central tooth.

Mesembrinus pallidior, Sowb.

See Terr. Moll., V.

Lingual membrane as in the following, not as in last species.

Mesembrinus chrysalis, Pfr. Martinique. Gov. Rawson.

Jaw of the type common in *Bulimulus*, *Cylindrella*, etc., arcuate, low ; ends blunt ; thin, transparent ; with eighteen narrow, separated ribs ; a transverse central line of reinforcement. Attached to the upper margin is a strong triangular membrane of the same consistence and material as the jaw itself, and equally resisting the action of potash, so as readily to be mistaken for the accessory plate of the *Succineæ*. (Pl. XV, fig. Q.)

Lingual membrane (Pl. XIV, fig. G) as usual in the *Helicinae*. Centrals about as broad as long, tricuspid, and median cusp short and stout, its short point not extending to the base of the plate. Laterals like the centrals, but bicuspid. Marginals wide, low, with one inner, long, blunt, stout, oblique denticle, and one or two short, blunt side denticles.

Thaumastus immaculatus, Ad. Jamaica. Mr. Gloyne.

Jaw as usual in *Bulimulus* ; over 36 ribs.

Lingual membrane (Pl. XII, fig. H) as in *Bul. chrysalis* ; central teeth with three cutting points.

Mormus membranaceus, Phil. Brazil. J. G. Anthony.

Jaw as usual ; with about 24 ribs.

Lingual membrane as in *Bul. chrysalis*.

Mormus laticinctus, Guppy. Dominica. Mr. Guppy.

Jaw not examined.

Lingual membrane (Pl. XII, fig. I) as in *Bul. Bahamensis*; the transverse rows of teeth in this type of membrane are waving.

Mormus sufflatus, Gld.

Jaw as usual in *Bulimulus*; about 21 ribs.

Lingual membrane as in *B. chrysalis*.

Mormus Jonasi, Pfr.

Jaw as usual in *Bulimulus*.

Lingual membrane as *B. Bahamensis*.

Scutalus rhodolarynx, Rve. Northern Peru. Prof. Orton.

Jaw ruined by the action of potash.

Lingual membrane (Pl. XII, fig. D) as in *B. chrysalis*; long and narrow; teeth 40-1-40.

Scutalus proteus, Brod. Northern Peru. Prof. Orton.

Jaw as usual; 28 ribs.

Lingual membrane as in *B. altoperuvianus*.

Leptomerus limnæoides, Fér. St. Kitts. Dr. Branch.

Jaw (Pl. XVI, fig. I) low, wide, semitransparent, slightly arcuate, ends scarcely attenuated, blunt; anterior surface with about sixteen ribs, denticulating either margin. It is extremely difficult to decide upon the character of these ribs. Some appear to be a simple thickening of the jaw, formed by the overlapping of distinct separate plates. Others remind me of the distant narrow ribs of most of the *Bulimuli*, of the character of the ribs in *Cylindrella*, etc. At other points upon the jaw there seem to be broad, flat ribs with narrow interstices.

Lingual membrane long and narrow (Pl. XII, fig. E). Teeth as usual in the *Helicinae*. The change from laterals to marginals is very gradual, the latter being but a modification of the former, with two cutting points, the inner the longer. Thus it appears that this species in its dentition agrees with *B. cinnamomeo-lineatus*, *pallidior*, *chrysalis*, *dealbatus*, *Guadalupensis*, *alternatus*, *sporadicus*, *solutus*, *sepulchralis*, *durus*, *Peruvianus*, *rhodolarynx*, and not with *laticinctus*, *Bahamensis*, *auris-leporis*, *papyraceus*, *Jonasi*, *membranaceus*, *trigonostomus*, *flavidus*, *virginalis*, *convexus*, *Vincentinus*, *Lobbi*, *alternans*, *multifasciatus*, *primularis*.

Teeth 30-1-30, with about ten laterals on each side. The outer cutting point of the marginals is sometimes bifid.

Leptomerus sepulcralis, Poey. New Providence, Bahamas.

Jaw stout, wide, low, arcuate, of about equal height throughout, ends bluntly rounded; anterior surface with 15 stout, broad, crowded ribs, their ends crenulating either margin; some of these ribs are of equal thickness throughout, and are separated by decided, narrow interstices; the jaw cannot, therefore, be said to resemble that usual in *Bulimulus*, though it seems to combine some of the characters of that and of the simply ribbed form of jaw.

Lingual membrane as in *B. chrysalis*; no side cutting points to centrals and inner laterals. (Pl. XI, fig. J.)

Leptomerus corneus. Nicaragua. Mr. McNiel.

Jaw as in *Bulimulus*; 15 ribs.

Lingual membrane as in *B. chrysalis*.

Rhinus durus, Spix. Brazil. J. G. Anthony.

Jaw as usual in *Bulimulus*.

Lingual membrane as in *B. chrysalis*.

Plectostylus Peruvianus, Brug. Talcahuana, Peru.

Jaw as usual in *Bulimulus*; 30 ribs.

Lingual membrane (Pl. XII, fig. J) combining the characters of that of *B. membranaceus* in the marginals with those of *B. chrysalis* in the centrals and the five laterals on both sides of the median line; the cusp of the last is large, oblique, rounded.

Bulimulus Edwardsi, Mor. Lake Titicaca. Prof. Alex. Agassiz.

Jaw low, arcuate, ends rapidly acuminate, blunt; anterior surface with over ten distant ribs, some of the usual *Helix* type, others like the delicate ribs common in *Cylindrella*, *Bulimulus*, *Gavotis*, *Amphibulima*, etc.

Lingual membrane (Pl. XI, fig. K) with 44-1-44 teeth. Centrals of the usual *Helicinae* type, tricuspid; laterals like centrals, asymmetrical, and consequently bicuspid. The change to marginals very gradual, and formed by the simple modification of the laterals, without any splitting of the inner cutting point.

Subgeneric position of this species is unknown to me, as of the following.

Bulimulus Gabbianus, Angas. Costa Rica. Dr. W. M. Gabb; formerly referred to *B. Irazuensis*.

Jaw as in *Bul. limnceoides*, but median ribs oblique; there are about 32 ribs.

Lingual membrane with marginals as in *B. Bahamensis*. (Pl. XII, fig. L.)

Cylindrella.

Jaw arched, ends attenuated; very thin, transparent; dis-

tant, delicate, oblique ribs, serrating either margin, those of the upper centre meeting or ending before reaching the lower margin.

Lingual dentition quite peculiar. As Messrs. Crosse and Fischer, in their exhaustive paper (Journ. de Conch., XVIII, Jan., 1870), have indicated the different types of dentition found in the genus, I have referred to their respective groups the various species I have examined.

Group A.—Two lateral teeth on each side of the median line; marginals of a different form, varying in number.

Cylindrella (Casta) Chemnitziana, Fér. ' Jamaica.

There are 10-1-10 teeth; two laterals on each side.

Cylindrella cyclostoma, Pfr. (*Trachella*.) Lomas de Camoa, Cuba. Mr. Arango.

Jaw with over 70 ribs.

Lingual membrane with 10-1-10 teeth, two being laterals on either side; the first marginal is a modification of the laterals, other marginals of usual long and narrow shape, upper margin reflected.

Cylindrella Humboldtiana, Pfr. Cuba. Mr. Arango.

Jaw with over 100 ribs.

Lingual membrane with 8-1-8 teeth, as in *C. rosea*, figured by Crosse and Fischer. The species belongs to their group *Thaumasia*.

Cylindrella rosea, Pfr. (*Urocoptis*.)

Jaw photographed in Am. Journ. Conch., V, p. 37.

Cylindrella subula, Fér. (*Mychostoma*.) Jamaica. Mr. H. Vendreyes.

Lingual membrane with 10-1-10 teeth, as in *C. gracilis*, figured by Crosse and Fischer. Lower margin of base of attachment of laterals delicately fringed or crimped; marginals 8, long, laminar, with irregularly recurved apices.

Cylindrella seminuda, Ad. (*Mychostoma*.) Jamaica. Mr. Gloyne.

Lingual membrane as in last species.

Group C.—Lateral teeth more than two; marginal teeth similar to, and not to be distinguished from, the laterals.

Cylindrella elegans, Pfr. (*Gongylostoma*.) Cuba. Mr. Arango.

Lingual membrane (Pl. XIV, fig. B) with 12-1-12 teeth arranged *en chevron*; centrals long, narrow, apex recurved with three short, bluntly trilobed cusps and large cutting point; laterals with one inner, widely expanding, oval, inner cutting point, surmounted by a blunt narrow pedicle, and one much smaller cutting point on a narrow, high pedicle; there are no distinct marginals, the teeth becoming much modified in shape as they pass off laterally.

Cylindrella ornata, Gundl. (*Gongylostoma*). Cuba. A dried specimen in Mr. Bland's collection.

Lingual membrane (Pl. XIV, fig. A) with 18-1-18 teeth; as in last species.

Cylindrella Poeyana, D'Orb.

See Terr. Moll., V.

Macroceramus.

Jaw as in *Cylindrella*.

Lingual membrane, See Terr. Moll. V.

Macroceramus Gossei, Pfr. See Terr. Moll., V.

Macroceramus turricula, Pfr. Lomas de Camoa, Cuba. Mr. Arango.

Jaw with 35 ribs.

Lingual membrane as in last species (Pl. XIV., fig. D).

Macroceramus inermis, Gundl. Curaçao. Mr. J. S. Gibbons.

Lingual membrane as in *M. Gossei*.

Pineria.

Pineria Viequensis, Pfr. Island of St. Martin. Dr. van Rijgersma.

Jaw with about 28 ribs as in *Cylindrella* (Pl. XV, fig. B); upper median portion of the jaw figured is imperfect.

Lingual membrane (Pl. XIV, fig. C) as in group A of *Cylindrella*; laterals two; marginals five or six, long, narrow, simple, with irregularly recurved upper margins.

Partula.

Jaw as in *Cylindrella*. Pl. XV, fig. O, represents that of an undetermined species; there are over 60 ribs on that of *P. virginea*.

Lingual membrane broad; (that of *amanda* is figured on Pl. XI, fig. L) the central tooth is as common in the *Helicidae*, with subobsolete side cusps, but side cutting points; the laterals are longer and broader than the central, with a side cusp and cutting point; the marginals have a long, narrow, quadrangular base of attachment, curving outward, extending beyond the reflection above; reflection small, with a highly developed cutting point, obliquely and bluntly tricuspid on its outer edge, the inner division the largest; the number of perfect laterals varies somewhat, 7 in *citrina*, 11 in *planilabrum*, 10 in *abbreviata* and *amanda*, 8 in *umbilicata*, *bilineata* and *virginea*; 5 in *gracilis*; there were 120 marginals in *virginea*; the number varies in the different species, but they are always numerous; the dentition of all examined by me agrees with the figure of that of *lirata* by Heynemann, Mal. Blatt., 1867, Pl. I, figs. 1—1a.

The species were determined by Mr. Garrett. I examined:—

<i>P. fusca</i> , Pease.	<i>lugubris</i> , Pease.
<i>citrina</i> , Pease.	<i>varia</i> , Brod.
<i>planilabrum</i> , Pease.	<i>compacta</i> , Pease.
<i>abbreviata</i> , Pease.	<i>Garretti</i> , Pease.
<i>umbilicata</i> , Pease.	<i>dentifera</i> , Pease.
<i>bilineata</i> , Pease.	<i>crassilabris</i> , Pease.
<i>amanda</i> , “ (Pl. XI, fig. L)	<i>Hebe</i> , Pfr.
<i>virginea</i> , Pease.	<i>protea</i> , Pease.
<i>gracilis</i> , Pease.	<i>globosa</i> , Pease.
<i>turgida</i> , Pease.	<i>approximata</i> , Pease.
<i>rosea</i> , Brod.	<i>faba</i> , Martyn.
<i>formosa</i> , Pease.	

ELASMOGNATHA.

Jaw with accessory plate to its upper margin.

Omalonyx.

Omalonyx felina, Guppy. Demarara. Mr. J. S. Gibbons.

Jaw with the accessory plate as usual in the genus.

Lingual membrane (Pl. XI, fig. M), centrals tricuspid ; laterals larger, but also tricuspid ; marginals irregularly pectinate.

Specimens from Trinidad have the same dentition.

Succinea.

For jaw and dentition, see Terr. Moll., V.

Succinea pallida, Pfr. Raiatea Island. Mr. A. Garrett.

Jaw as usual ; no anterior ribs.

Lingual membrane (Pl. X, fig. K) with about 30-1-30 teeth ; eleven laterals on either side.

Succinea papillata, Pfr.

Jaw as in last.

Lingual membrane (Pl. X, fig. L) with 25-1-25 teeth, nine laterals on each side ; some of the outer laterals have their outer cutting point bifid.

Succinea sagra, D'Orb. Jamaica

Jaw as usual ; a median projection to cutting edge.

Lingual membrane as usual in the genus.

Succinea canella, Gld. West Maui, Sandwich Islands.

Jaw and lingual membrane as usual.

Succinea Barbadosis, Guild. Barbadoes.

As in last species.

GONIOGNATHA.

Jaw in separate pieces : the upper median one usually triangular.

Orthalicus.

For jaw and lingual membrane, see Terr. Moll., V.

Orthalicus obductus, Shuttl. Islands in the Bay of Panama. Mr. McNiel.

Jaw as usual in the genus.

Lingual membrane (Pl. XII, fig. B) as usual in the genus, with lateral teeth ; teeth about 96-1-96. The base of attachment in centrals and first marginals is extended beyond the reflection.

Orthalicus gallina-sultana, Chemn. Marañon, Peru. Prof. Orton.

Jaw with 15 plates (Pl. XV, fig. N).

Lingual membrane (Pl. XII, fig. C) 13 mm. broad, 16 mm. long. The rows of teeth are arranged in a backward curve from the median line for a short distance, and then run obliquely to the outer margin of the membrane; marginals as usual in the genus, but the central tooth differs in having a long, stout, lance-like cutting point, bearing at the middle of each side a prominent, subobsolete, blunt spur; three laterals on either side like the central, but asymmetrical, with the spur only on their outer sides; teeth in one row 108-1-108.

Liguus.

For jaw and lingual membrane, see Terr. Moll., V.

Liguus virgineus. Linn. Aux Cayes, Haiti. R. Swift.

Lingual membrane (Pl. XII, fig. A).

The marginal teeth are as usual in the genus, but centrals and laterals differ; membrane $4\frac{1}{2}$ x 18 mm.; teeth 40-1-40; the centrals and two first laterals have a short, stout, pointed cutting point, of the same type as described in *Orthalicus gallina-sullana*.

This completes the list of terrestrial Pulmonata* examined by me; the following have also been described from other orders, generally with a figure.

PULMONATA LIMNOPHILA.

Melampus bidentatus. SAY. Ann. Lyc. N. H. of N. Y., IX, 286.

Alexia myosotis, DR. L. & Fr. W. Sh. N. A., II, 1.

Carychium exiguum, SAY. " " " 6.

Limnea appressa, SAY. Am. Journ. Conch., VII, 161; L. & Fr. W. Sh., II, 28.

stagnalis, L. L. & Fr. W. Sh., II, 155.

megasoma, SAY. Am. Journ. Conch., VII, 162.

columella, SAY. L. & Fr. W. Sh. N. A., II, 24.

catascopium, SAY. " " " 55.

Pompholyx effusa, Lea. Am. Journ. Conch., VI, 312.

* Excepting *Buliminus Natalensis*, unfortunately omitted. (See Ann. N. Y. Acad. Sci., I, 362, Pl. XV, fig. J.)

- Physa vinosa*, GLD. L. & Fr. W. Sh. N. A., II, 81.
ancillaria, SAY. " " " 83.
Physa ———. Ann. Lyc., IX, 255.
Planorbis trivolvis, SAY. Ann. Lyc., IX, 292.
Ancylus Newberryi, LEA. L. & Fr. W. Sh. N. A., II, 22.
Erinna Newcombi A. AD. Ann. Lyc., X, 349; Phila. Proc., 1374, 54.
Gundlachia Californica, ROWELL. L. & Fr. W. Sh. N. A., II, 148.

PECTINIBRANCHIATA.

- Geomelania*. Am. Journ. Conch., VII, 185.
Blandiella reclusa, GUPPY. " " "
Megalomastoma bituberculatum, SOWB. Am. Journ. Conch., VI, 213.
Tulotoma magnificum, CONRAD. Ann. Lyc., IX, 293.
Pomus depressa, SAY. L. & Fr. W. Sh., III, 1.
Vivipara intertexta, SAY. " " 16.
Melantho integra, SAY. " " 35.

SCUTIBRANCHIATA.

- Neritella reclinata*, SAY. L. & Fr. W. Sh., III, 101.
Stoastoma pisum, AD. Am. Journ. Conch., VII, 184.
Helicina occulta, SAY. Ann. Lyc., IX, 287; Am. Journ. Conch., VII, 29.
 ———. L. & Fr. W. Sh., III, 116.
orbiculata, SAY. Am. Journ. Conch., VI, 214.

DESCRIPTION OF PLATES.

PLATE II.

LINGUAL DENTITION OF

- Fig. A. *Nanina subcircula*, Mouss.
 B *implicata*, Nevill.
 C *argentea*, Rve.
 D *Rawsonis*, Barclay.
 E *Calias*, Bens.
 F *Calias*, Bens. Abnormal central tooth.
 G. *Limax semitectus*, Mörch.
 H. *Velifera Gabbi*, W. G. Binn.
 I. *Macrocyclus euspira*, Pfr.

- J. *Leucochroa* Boissieri, Charp.
- K. *Sagda* Haldemaniana, Ad.
- L. *Patula* Huahinensis, Pfr.
- M. *Endodonta* tumuloides, Garrett.
- N. " incerta, Mouss.
- O. *Acavus* Phoenix, Pfr.

PLATE III.

LINGUAL DENTITION OF

- Fig. A. *Onchidium* Schrammi, Bl.
 B. *Veronicella* — (from Brazil).
 C. *Polymita* muscarum, Lea.
 D. " " (central magnified).
 E. " *picta*, Born.
 F. *Tornatellina* aperta, Pse.
 G. *Achatinella* producta, Rve.
 H. *Geomalacus* maculosus, Allm.
 I. *Pella* rariplicata, Bens.

PLATE IV.

LINGUAL DENTITION OF

- Fig. A. *Hemitrochus* Troscheli, Pfr.
 B. " *gallopavonis*, Val.
 C. " *rufoplicata*, Poey.
 D. " *Milleri*, Pfr.
 E. " *graminicola*, Ad.
 F. *Caraculus* excellens, Pfr.
 G. " *Sagemon*, Beck, Cuba.
 H. " " " Gonave Is. Haiti.
 I. " *Arangiana*, Poey.
 J. " *marginella*, Gmel.

PLATE V.

LINGUAL DENTITION OF

- Fig. A. *Cysticopsis* tumida, Pfr.
 B. " *pemphigodes*, Pfr.
 C. *Plagioptycha* loxodon, Pfr.
 D. " *Albersiana*, Pfr.
 E. " *monodonta*, Lea.
 F. " *Duclosiana*, Fér.
 G. " *diaphana*, Lam.
 H. " *macroglossa*, Pfr.
 I. *Leptoloma* fuscocincta, Ad.

- J. *Coryda Gossei*, Pfr.
 K. *Plebicula lurida*, Lowe.
 L. *Helix*,—Ann. N. Y. Ac. Sc., I, 261 (see p. 113).

PLATE VI.

LINGUAL DENTITION OF

- Fig. A. *Newcombia venusta*, Mighels.
 B. *Laminella picta*, Mighels.
 C. " *obesa*, Newc.
 D. " *decorticata*, Gul.
 E. " *Mastersi*, Newc.
 F. " *luctuosa*, Pfr.
 G. *Leptachatina textilis*, Fér.
 H. " *nitida*, Newc.
 I. *Carelia bicolor*, Jay.
 J. *Fruticicola pubescens*, Pfr.
 K. *Dorcasia pyrozoona*, Phil.
 L. " *similaris*, Fér.
 M. " *globulus*, Müll.
 N. *Turricula tuberculosa*, Conr.

PLATE VII.

LINGUAL DENTITION OF

- Fig. A. *Strophia decumana*, Fér.
 B. " *mumia*, Brug.
 C. " *iostoma*, Pfr.
 D. *Stenogyra hasta*, Pfr.
 E. *Cionella Gloynei*, Gibbons.
 F. *Cæcilianella Gundlachi*, Pfr.
 G. *Lithotis rupicola*, Blandf.
 H. *Clausilia tridens*, Chemn.
 I. *Anadenus*, ———.
 J. *Simpulopsis corrugatus*, Guppy.
 K. *Cryptostrakon Gabbi*, W. G. B.
 L. *Microphysa circumfirmata*, Redf.

PLATE VIII.

LINGUAL DENTITION OF

- Fig. A. *Pomatia Humboldtiana*, Val.
 B. " *Sieboldtiana*, Phil.
 C. *Leptaxis undata*, Lowe.

- D. *Thelidomus discolor*, Fér.
- E. " *aspera*, Fér.
- F. " *auricoma*, Fér.
- G. " *notabilis*, Shuttl.
- H. " *Jamaicensis*, Chemn.
- I. " *provisoria*, Pfr.
- J. *Eurycratera angulata*, Fér.
- K. " *crispata*, Fér.
- L. *Polydotes Luquillensis*, Shuttl.
- M. *Stylodon Studeriana*, Fér.
- N. *Tebennophorus Costaricensis*, Mörch ?

PLATE IX.

LINGUAL DENTITION OF

- Fig. A. *Dentellaria orbiculata*, Fér.
- B. " *Isabellæ*, Fér.
 - C. " *dentiens*, Fér.
 - D. " *nucleola*, Rang.
 - E. " *nuxdenticulata*, Chemn.
 - F. " *pachygastra*, Gr.
 - G. " *badia*, Fér.
 - H. " *formosa*, Fér.
 - I. " *Josephinæ*, Fér.
 - J. " *perplexa*, Fér.
 - K. " *lychnuchus*, Müll.

PLATE X.

LINGUAL DENTITION OF

- Fig. A. *Pleurodonta acuta*, Lam.
- B. " *Carmelita*, Fér.
 - C. " *Schroeteriana*, Pfr.
 - D. " *invalida*, Ad.
 - E. *Merope fringilla*, Pfr.
 - F. *Helix astur*, Souv.
 - G. " *convicta*, Cox.
 - H. *Macrodonates odontostomus*, Sowb.
 - I. *Pelecychilus auris-Sileni*, Born.
 - J. " *glaber*, Gmel.
 - K. *Succinea pallida*, Pfr.
 - L. " *papillata*, Pfr.

PLATE XI.

LINGUAL DENTITION OF

- Fig. A. *Anthinus multicolor*, Rang.
 B. *Pachyotus egregius*, Jay.
 C. *Orphnus foveolatus*, Rve.
 D. " *Hanleyi*, Pfr.
 E. *Dryptus marmoratus*, Dunker.
 F. *Eurytus aulacostylus*, Pfr.
 G. *Canistrum fulgetrum*, Brod.
 H, I. *Gæotis*, ———.
 J. *Leptomerus sepulchralis*, Poey.
 K. *Bulimulus Edwardsi*, Mor.
 L. *Partula amanda*.
 M. *Omalonyx felina*, Guppy.

PLATE XII.

LINGUAL DENTITION OF

- Fig. A. *Liguus virgineus*, Lin.
 B. *Orthalicus obductus*, Shuttl.
 C. " *gallina-sultana*, Chemn.
 D. *Scutalus rhodolarynx*, Rve.
 E. *Leptomerus limnæoides*, Fér.
 F. *Drymæus Bahamensis*, Pfr.
 G. *Mesembrinus primularis*, Rve.
 H. *Thaumastus immaculatus*, Ad.
 I. *Mormus laticinctus*, Guppy.
 J. *Plectostylus Peruvianus*, Brug.
 L. *Bulimulus Irazuensis*, Ad.

PLATE XIII.

LINGUAL DENTITION OF

- Fig. A. *Amphibulima patula*, Brug. St. Kitts.
 B. " " " "
 C. " " " Dominica.
 D. " " " "
 E. " *appendiculata*, Pfr.
 F. " *rubescens*, Desh.
 G, H. " *Rawsonis*, Bl.

PLATE XIV.

LINGUAL DENTITION OF

- Fig. A. *Cylindrella ornata*, Gundl.
B. " *elegans*, Pfr.
C. *Pineria Viequensis*, Pfr.
D. *Macroceramus turricula*, Pfr.
E. *Drymæus Lobbi*, Rve.
F. " *altoperuvianus*, Rve.
G. *Mesembrinus chrysalis*, Pfr.

PLATE XV.

JAW OF

- Fig. A. *Gæotis*.
B. *Pineria Viequensis*, Pfr.
C. *Microphysa turbiniformis*, Pfr.
D. *Amphibulima rubescens*, Desh.
E. " *patula*, Brug.
F. " *appendiculata*, Pfr.
G. *Pella rariplicata*, Benson.
H. *Fruticicola pubescens*, Pfr.
I. *Stenogyra hasta*, Pfr.
J. *Clausilia tridens*, Pfr.
K. *Polymita muscarum*, Lea.
L. *Limax semitectus*, Mörch ?
M. *Caracolus Arangiana*, Poey.
N. *Orthalicus gallina-sultana*, Chem.
O. *Partula*.
P. *Bulimulus (Drymæus) Lobbi*, Rve.
Q. " (*Mesembrinus*) *chrysalis*, Pfr.

PLATE XVI.

JAW OF

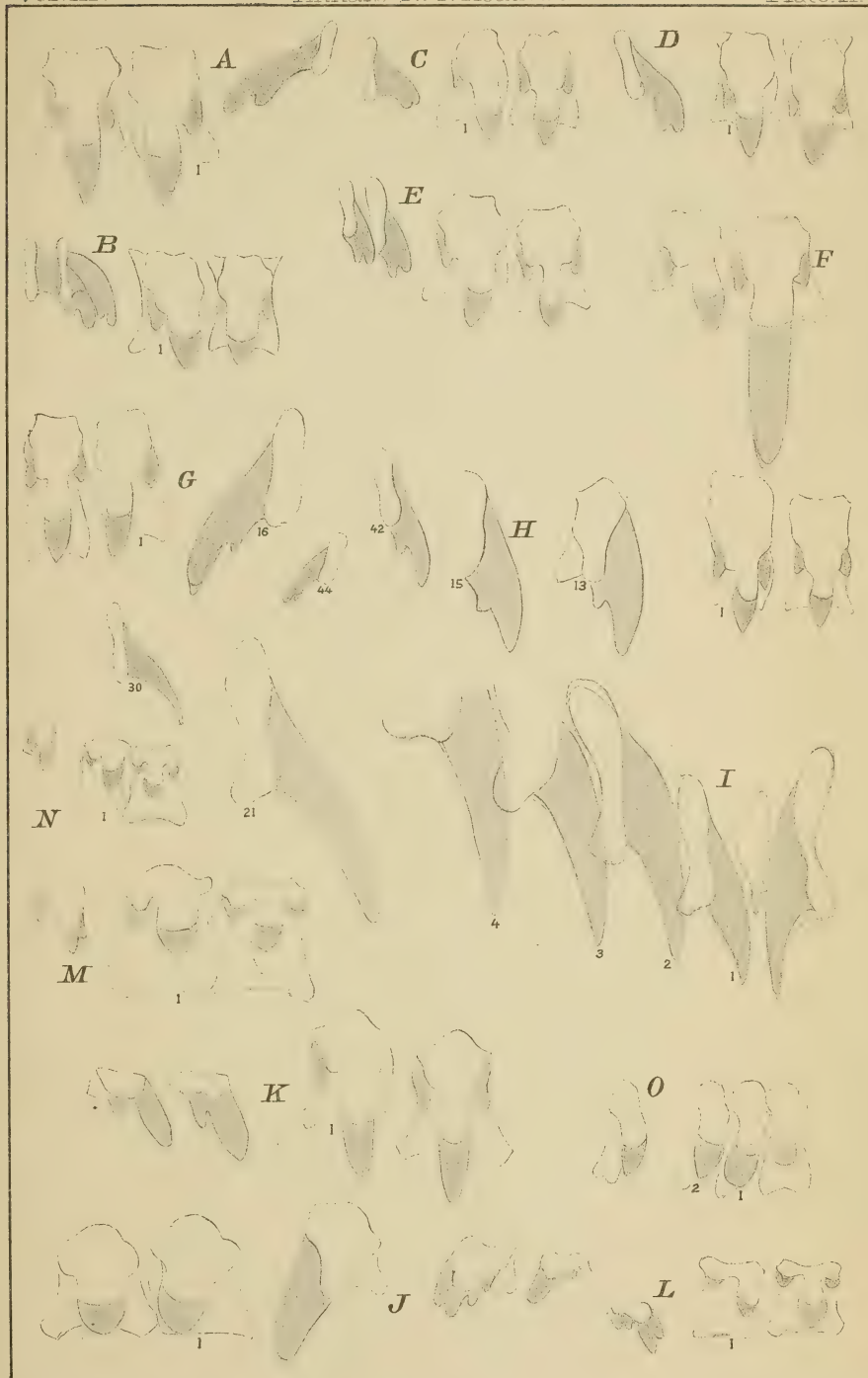
- Fig. A. *Cysticopsis tumida*, Pfr.
B. *Helix astur*, Souv.
C. *Lithotis rupicola*, Blandf.
D. *Carelia bicolor*, Jay.
E. *Achatinella (Laminella) Mastersi*, Newe.
F. G. *Cæcilianella Gundlachi*, Pfr.
H. *Pomatia Sieboldtiana*, Phil.
I. *Bulimulus (Leptomerus) limnæoides*, Fér.
J. *Hemitrochus Milleri*, Pfr.

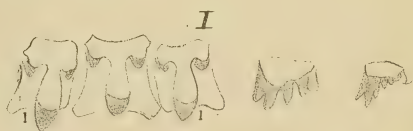
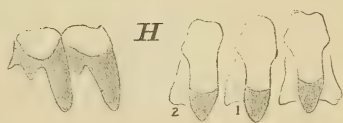
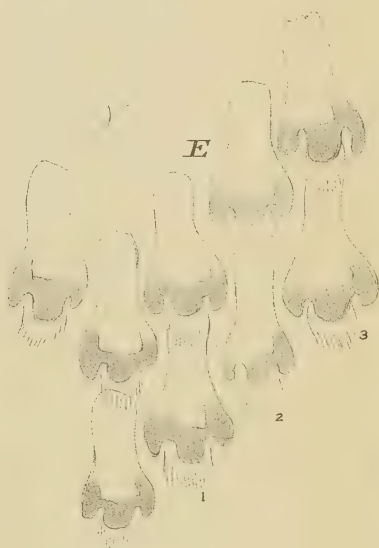
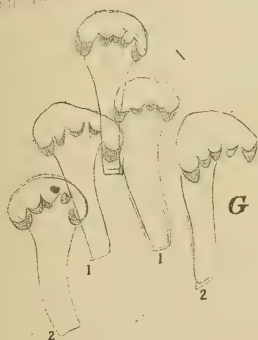
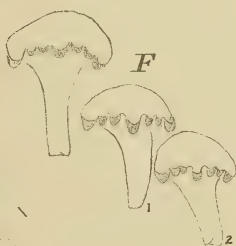
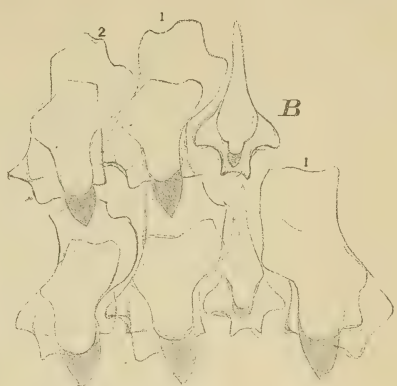
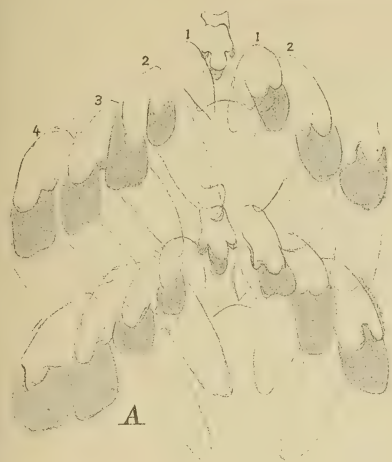
- K. *Urocyclus Kirki*, Gray.
- L. *Cryptostrakon Gabbi*, W. G. Binn.
- M. *Achatinella* (*Newcombia*) *picta*, Mighels.
- N. *Dentellaria dentiens*, Pfr.
- O. " *nucleola*, Rang.
- P. " *pachygastra*, Gr.
- Q. " *badia*, Fér.
- R. " *formosa*, Fér.
- S. " *Josephinae*, Fér.
- T. " *perplexa*, Fér.
- U. " *lychnuchus*, Müll.
- V. " *nuxdenticulata*, Fér.
- W. " *orbiculata*, Fér.

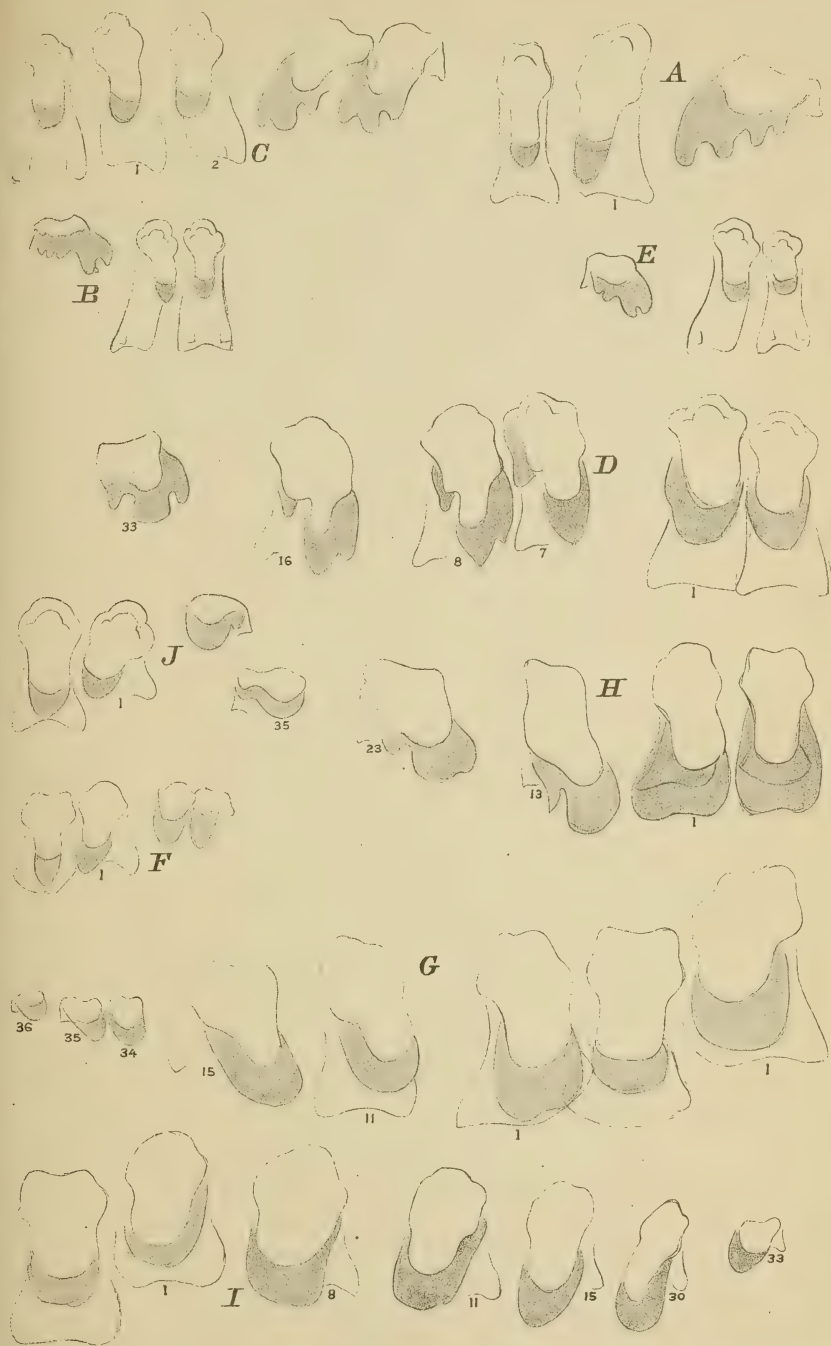
PLATE XVII.

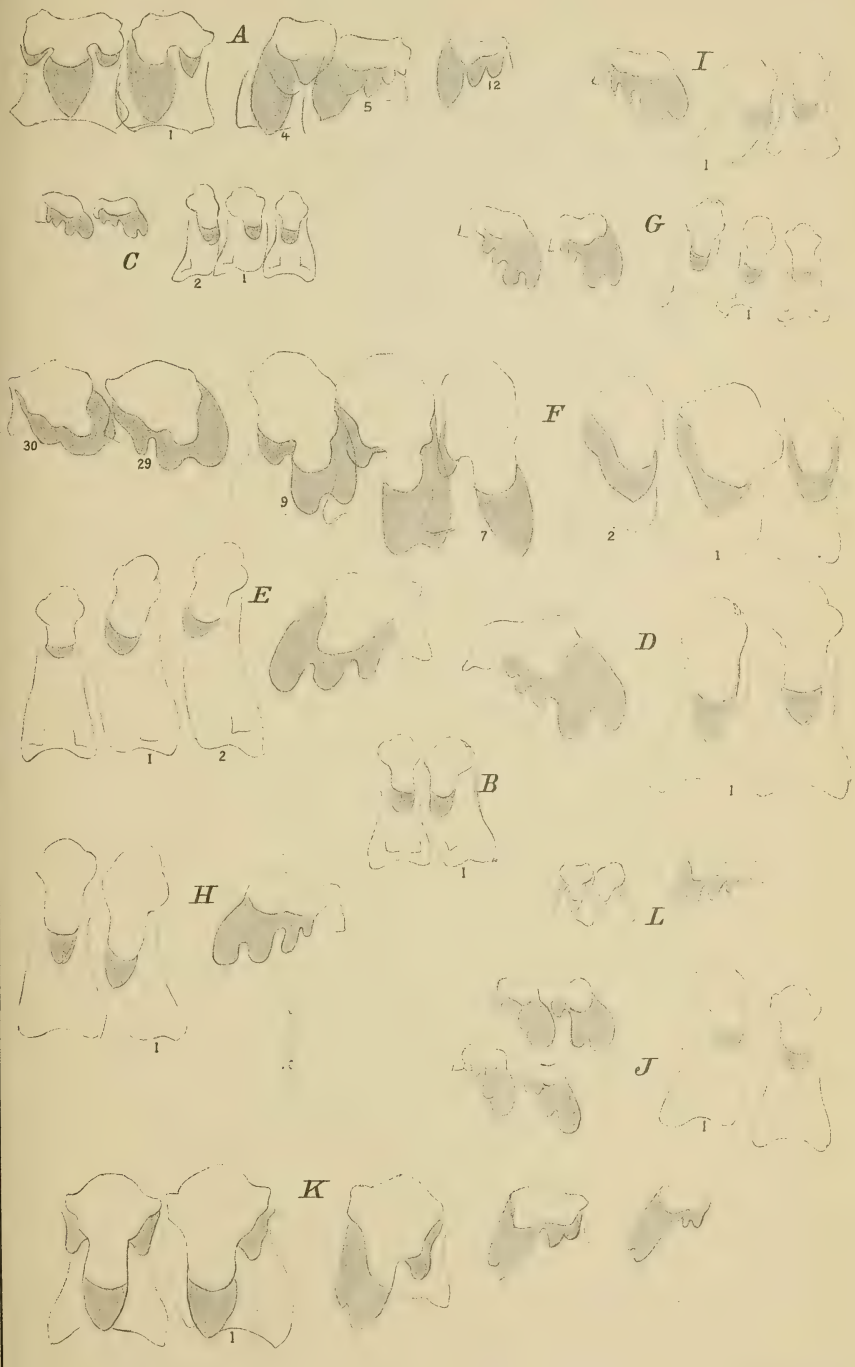
LINGUAL DENTITION OF

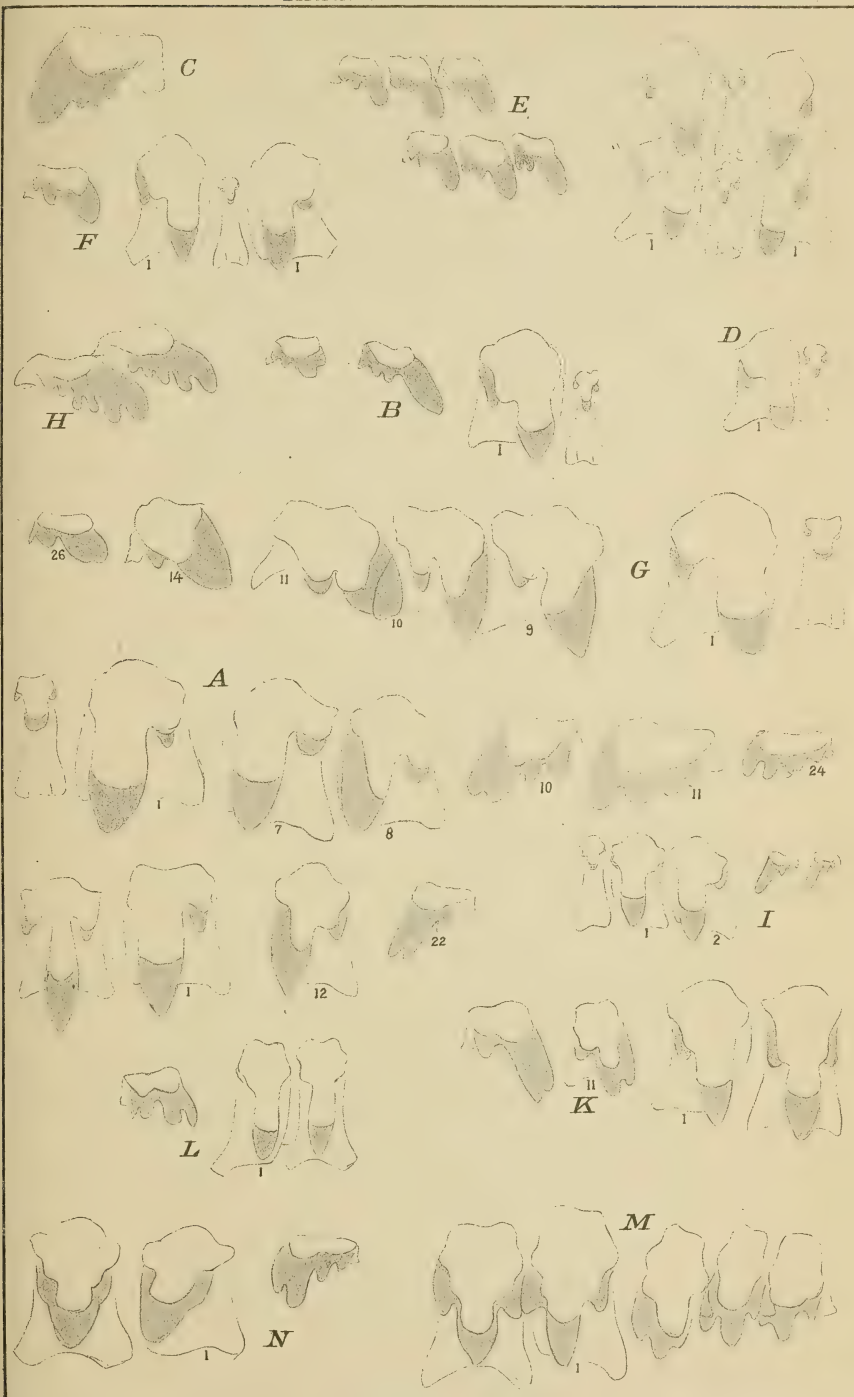
- Fig. A. *Chlamydephorus Gibbonsi*, W. G. B.
 B. *Glandina rosea*, Fér.
 C. " *semitarum*, Rang.
 D. " *Phillipsi*, Ad.
 E. " *aurata*, Mor.
 F. *Gonospira palanga*, Fér.
 G. " *Newtoni*, H. Ad.
 H. " *Mauritiana*, Mor.
 I. " *Nevilli*, H. Ad.
 J. *Ennea clavatula*, Lam.
 K. *Spiraxis Dunkeri*, Pfr.
 L. *Rhytida vernicosa*, Kraus.
 M. *Stenopus decoloratus*.
 N. *Urocyclus Kirki*, Gr.
 O. *Nanina Chamoissi*, Pfr.
 P. " *radians*, Pfr.
 Q. *Trochomorpha Cressida*, Gld.

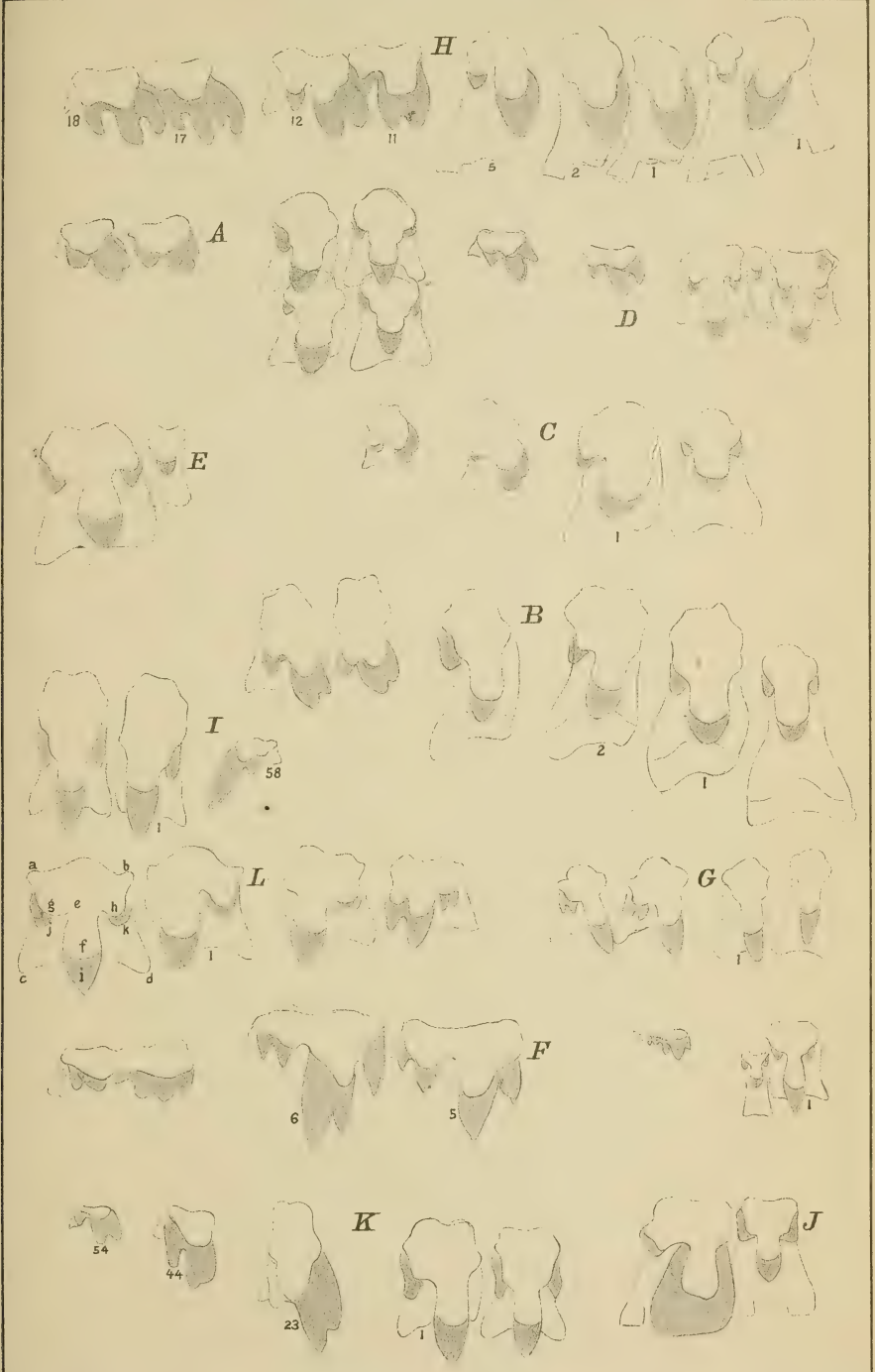


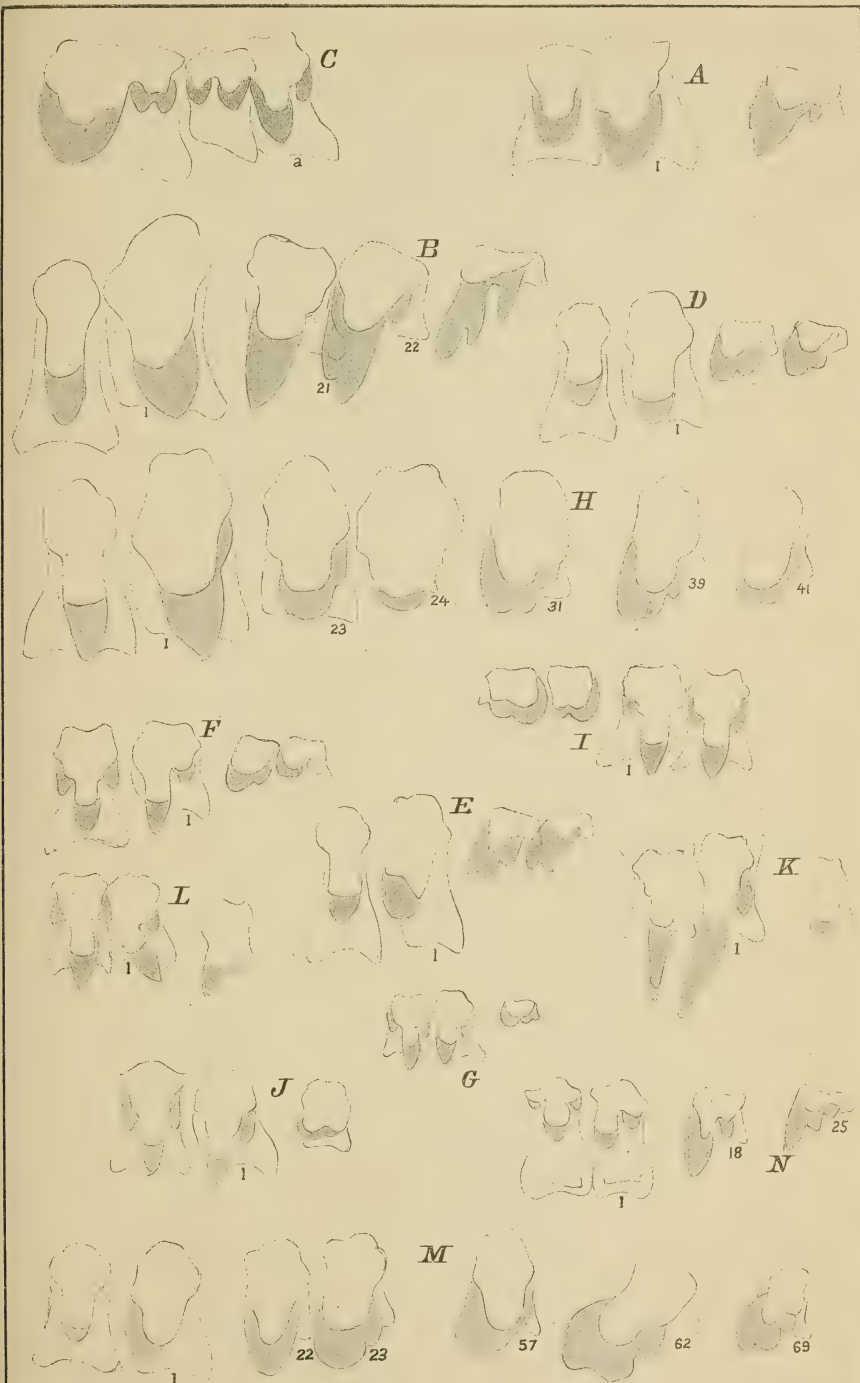


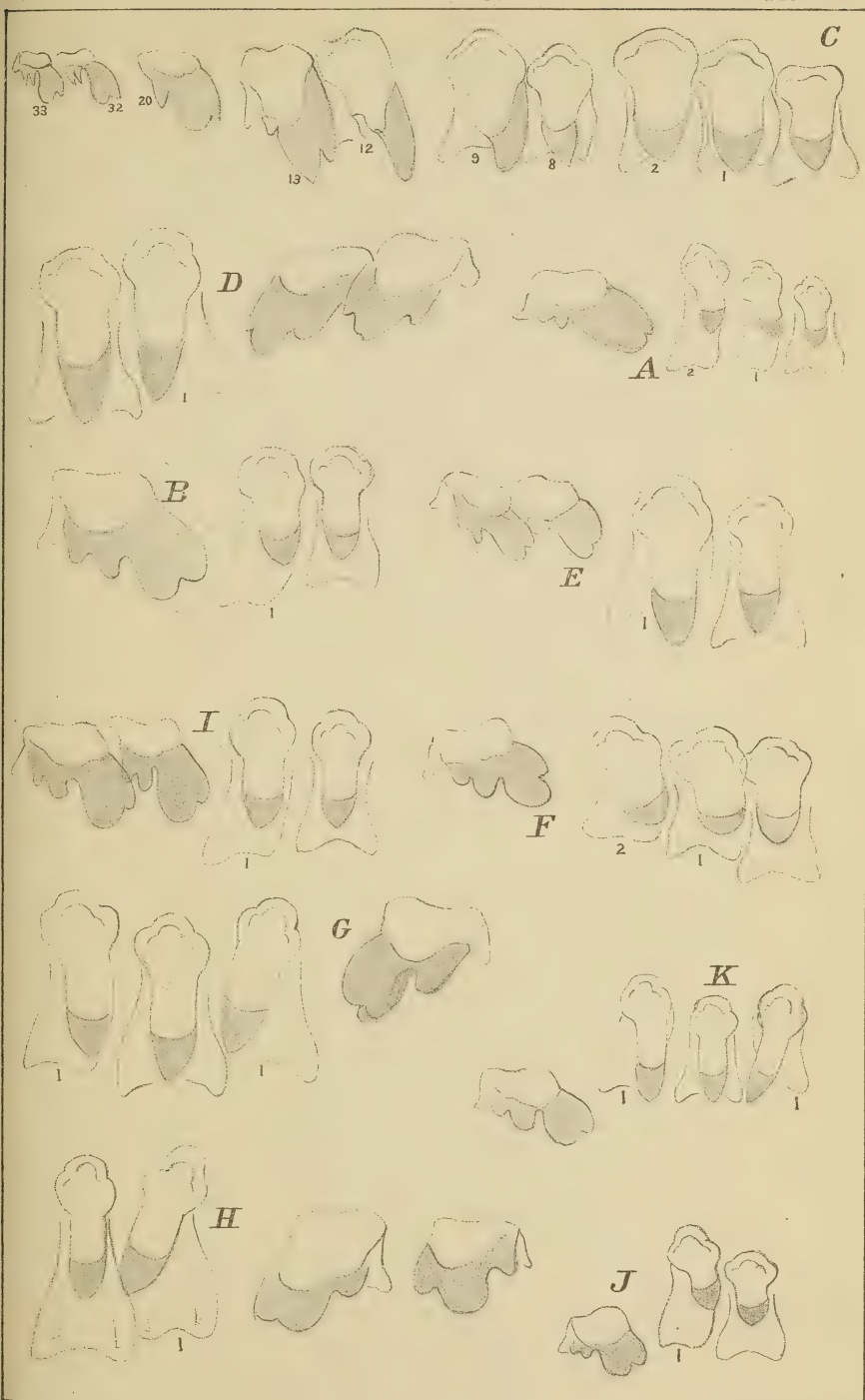


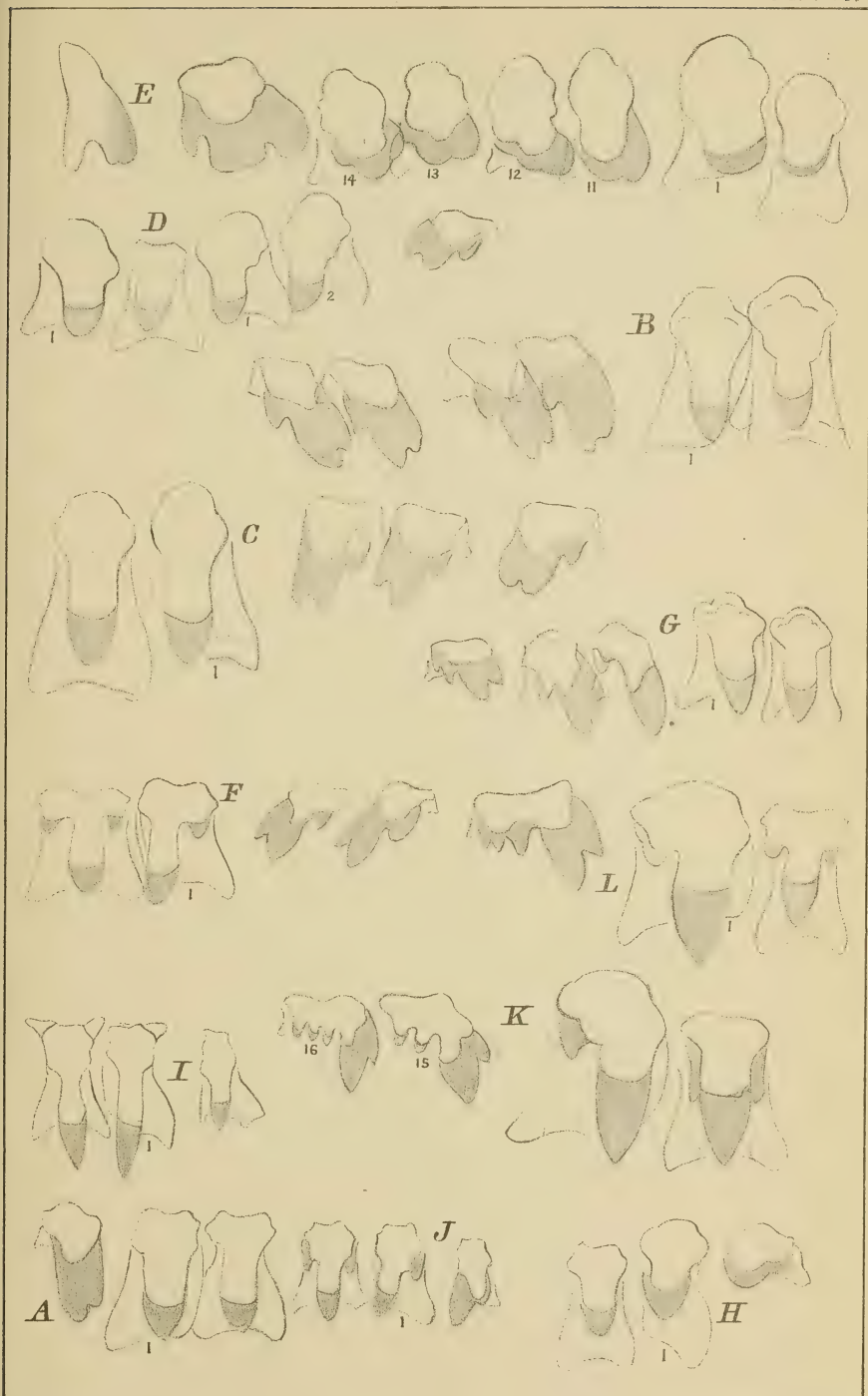




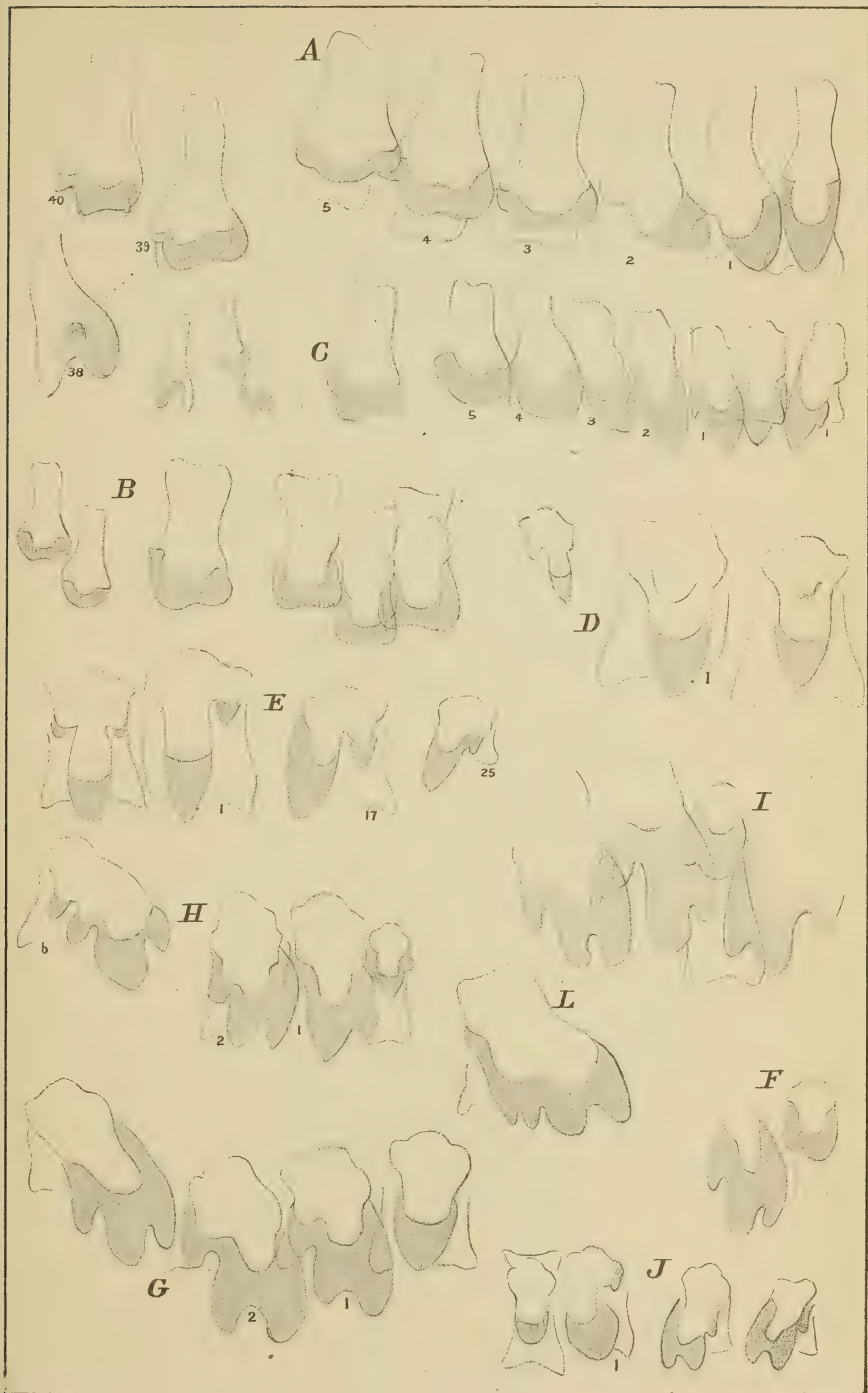


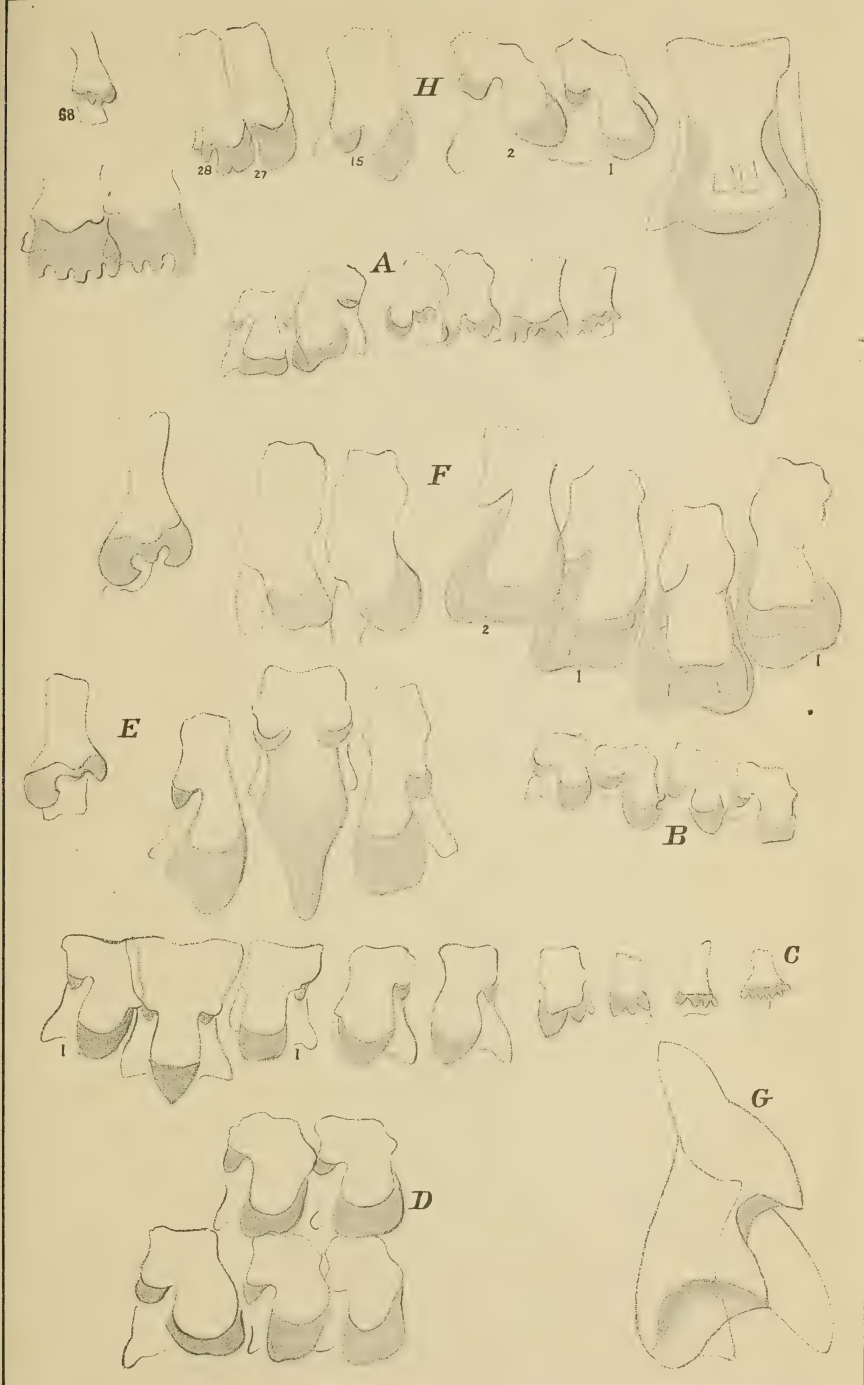


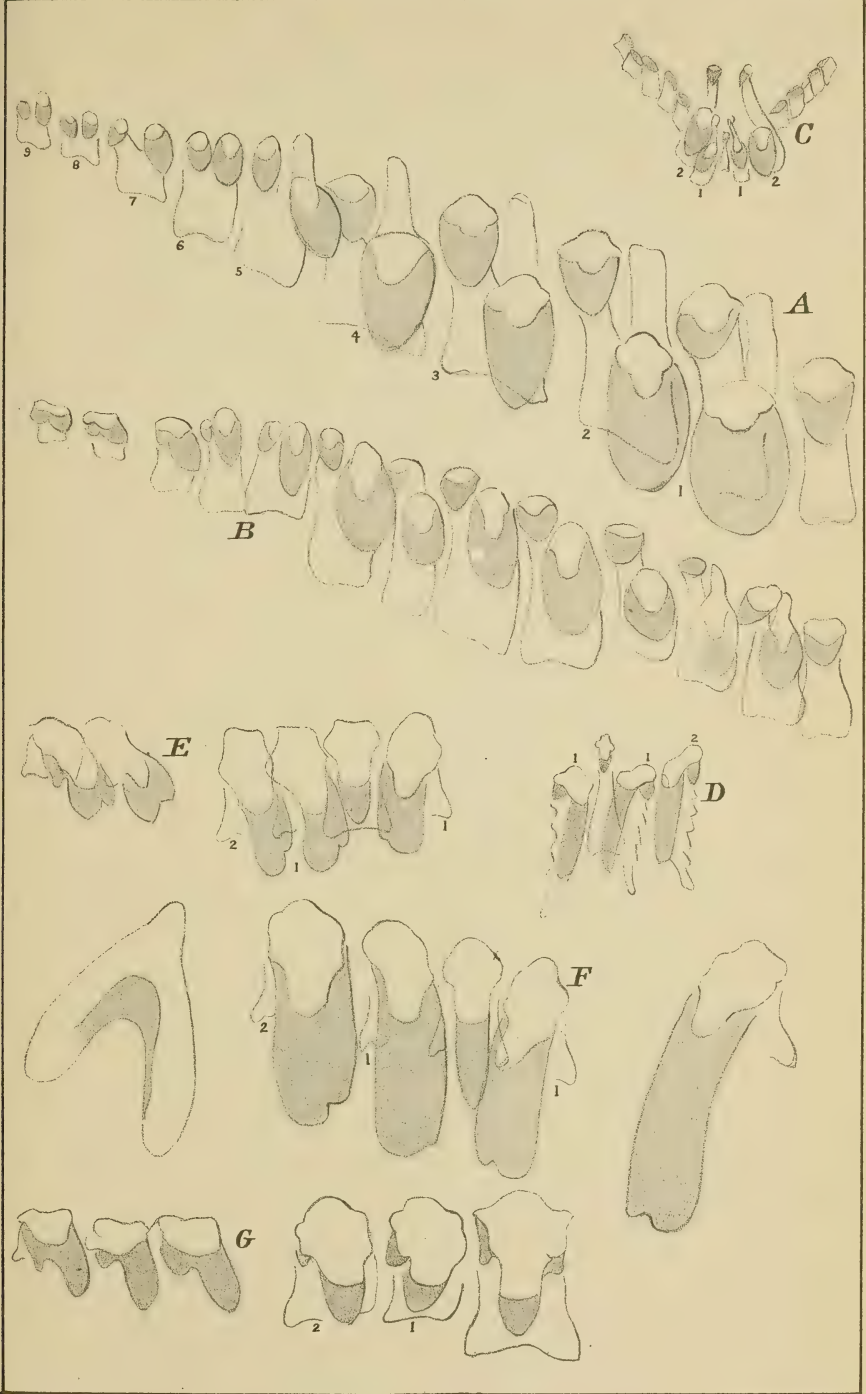


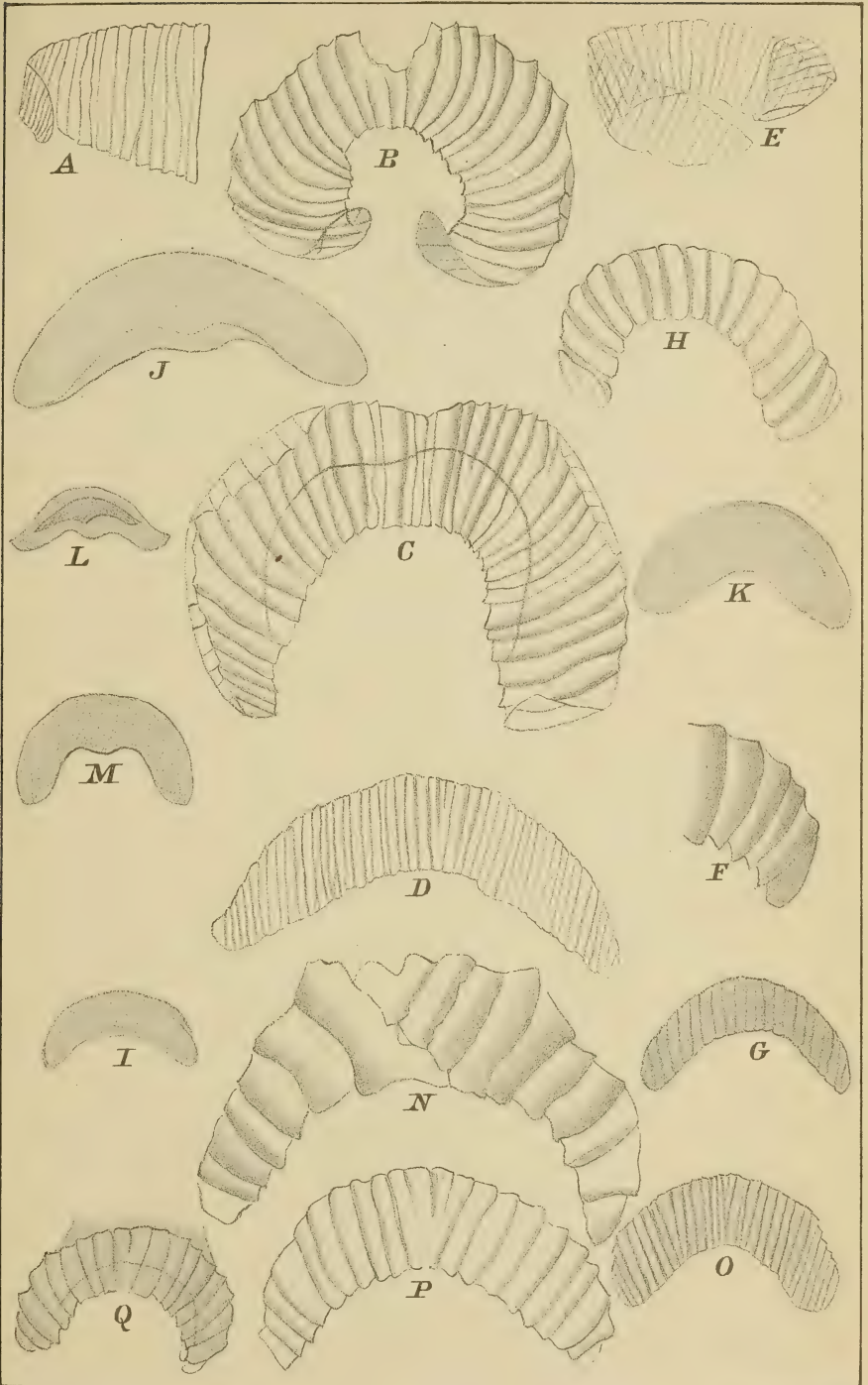


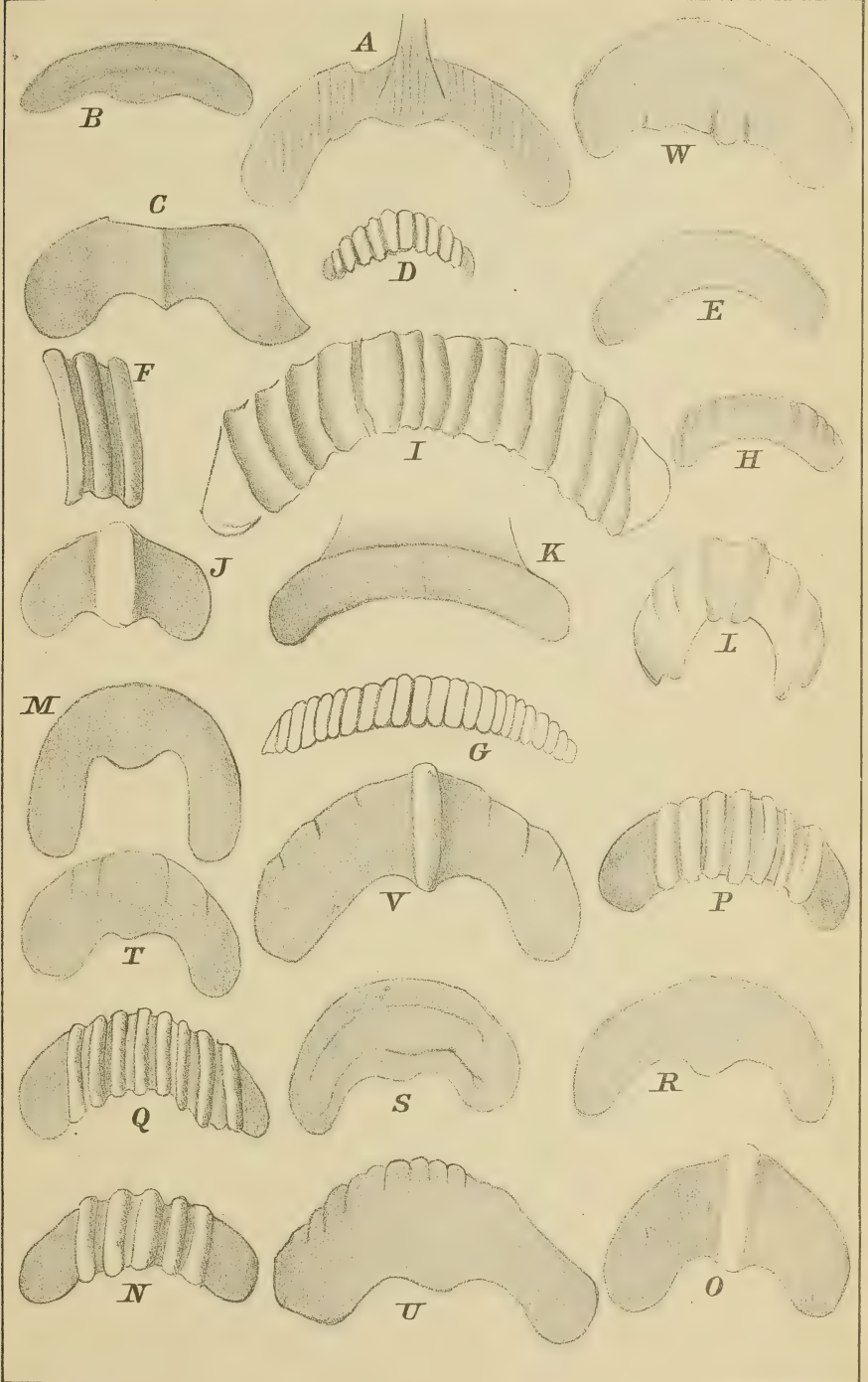


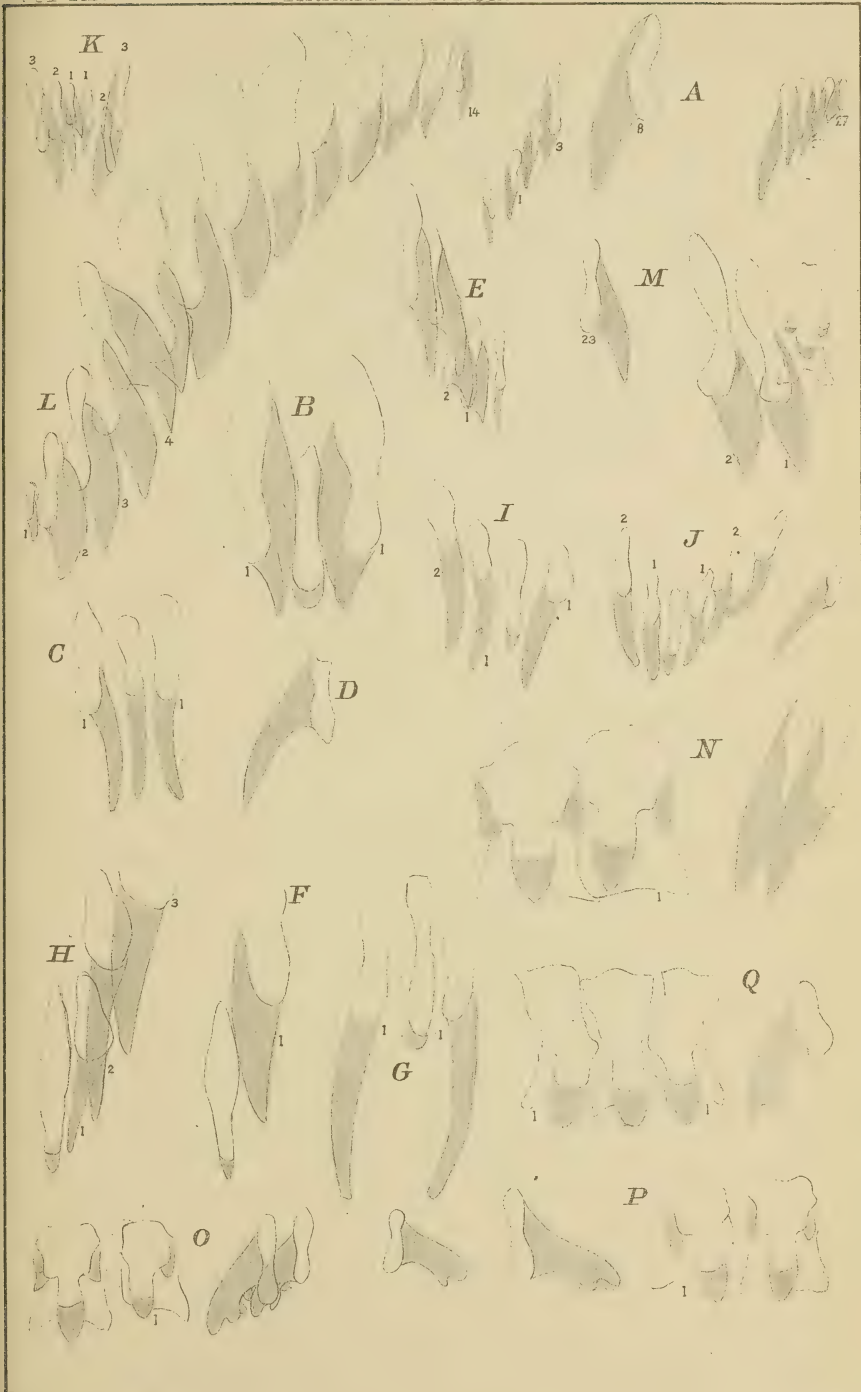
















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